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TCRP Report 40

Strategies to Attract Auto Users to Public Transportation

Transportation Research Board
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Report 40

Strategies to Attract Auto Users to Public Transportation

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000,* also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA; the National Academy of Sciences, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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NOTICE

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Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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FOREWORD

By Staff
Transportation Research Board

This report will be of interest to transportation and urban planners and to local decisionmakers. The effectiveness of automobile parking strategies as a means of increasing transit ridership was analyzed. Eight strategies affecting the price and availability of parking and transit service levels were examined, alone and in combination, to assess their effects on travel mode choice, particularly transit. The final chapter of the report is an implementation guide for transportation planners and decisionmakers.

TCRP Project H-3, *Strategies to Attract Auto Users to Public Transportation,* focused on parking strategies as a means of increasing transit patronage, particularly for work trips. Specifically, the following research questions were pursued in this project:

- How does parking price and transit service affect transit use in U.S. cities?
- How does parking price and transit service affect transit use for downtown-destined work trips?
- How does increasing parking price compare with other strategies in reducing worktrip single-occupancy vehicle (SOV) travel?
- How do different parking strategies compare with one another in reducing SOV worktrips?

To answer these questions, the researchers examined eight price- and non-price-based parking strategies, alone and in combination, to determine their effect on mode choice, their political feasibility, and their potential secondary consequences. The price-based parking strategies were increasing the price of parking through a tax on parking revenues, increasing the price of parking through a tax on parking spaces, cashing-out employer-provided parking,[1] increasing the number of parking meters and accompanying residential permit programs, and imposing parking impact fees. The non-price-based strategies were changes in zoning ordinances to restrict parking supply, shared parking, and transportation demand management.

The study concludes that no single strategy is both effective and politically feasible enough to warrant implementation throughout a metropolitan area. Rather, the researchers recommend that policy-makers implement combinations of parking strategies, in response to the policy and transportation objectives of specific geographical areas. The final chapter of the report, an implementation guide, provides forms, examples, and other information to assist agencies in selecting combinations of parking strategies that will be appropriate for local needs.

[1] This is a program that allows employees, whose employers currently provide free parking, to choose between a taxable cash equivalent or a tax-exempt free parking place. Employees who choose the cash equivalent can use it for any purpose, including an alternative form of transportation.

CONTENTS

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Dr. Kenneth J. Dueker, Director of the Center for Urban Studies, Portland State University, was the Principal Investigator. Dr. James G. Strathman, Associate Director of the Center for Urban Studies, was the Co-Principal Investigator. Dr. Martha J. Bianco, Assistant Director of the Center for Urban Studies, was the Principal Author.

Others contributing to the analysis and this report are Dr. Martha J. Bianco, Mr. Eric Engstrom, Ms. Catherine Lawson, Dr. Gerard C.S. Mildner, Dr. Anthony Rufolo, and Dr. James G. Strathman, of Portland State University; Dr. Zhong-Ren Peng, formerly of Portland State University and now of the University of Wisconsin at Milwaukee; Dr. Judy Davis, formerly of Portland State University and now of Parsons Brinckerhoff Quade & Douglas, Inc.; Mr. Thomas Rossi, Mr. Earl Ruiter, and Ms. Rita Vaidya, of Cambridge Systematics, Inc.; Dr. Randy Pozdena, Mr. Greig Harvey, and Mr. David Reinke, of ECO Northwest; and Dr. A.C. Nelson, Dr. Erik Ferguson, Dr. Michael Meyer, and Dr. Catherine Ross, of Growth Management Analysts, Inc.

The work was done under the direction of Dr. Dueker. Dr. Bianco wrote Chapters 1, 5, 6, 7, and 8. Dr. Rufolo and Dr. Bianco cowrote Chapter 2. Dr. Mildner, Dr. Strathman, and Dr. Bianco cowrote Chapter 3. Chapter 4 was cowritten by Dr. Dueker, Dr. Strathman, Dr. Zhong-Ren Peng, Dr. Pozdena (with the assistance of Mr. Harvey and Mr. Reinke) and Mr. Rossi (with the assistance of Mr. Ruiter and Ms. Vaidya).

The case studies used for illustrative purposes throughout the report were conducted by Dr. Davis, Dr. Mildner, and Dr. Bianco (Portland case study); Dr. Mildner (20-city survey); Dr. Ferguson (edge city survey); Dr. Nelson, Dr. Ferguson, Dr. Meyer, and Dr. Ross (Midtown Atlanta case study); and Ms. Lawson and Dr. Dueker (university and hospital case studies).

STRATEGIES TO ATTRACT AUTO USERS TO PUBLIC TRANSPORTATION

SUMMARY

The Clean Air Act Amendments of 1990 (CAAA) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) are both examples of recent federal legislation requiring improvements in air quality and congestion through more efficient transportation and an integration of multiple modes. Increasing public transit ridership has emerged as a primary goal of policy makers seeking to comply with legislation such as CAAA and ISTEA. Several policies are being examined for their potential to persuade automobile drivers to use transit. This report focuses on parking strategies as a means of increasing transit patronage for the work trip. For comparison purposes, this report also briefly considers some nonparking strategies, such as road pricing, to assess their effect on single-occupancy vehicle (SOV) use and transit ridership.

METHODOLOGY

The researchers undertook several modeling activities and complemented these with qualitative case studies.

The research team supplemented several modeling activities with qualitative and case study analyses. The modeling activities included the following:

- The researchers augmented cross-sectional data from the 1990 Nationwide Personal Transportation Survey (NPTS) with information regarding congestion and transit service levels for 20 metropolitan areas. They used these data to estimate how changes in transit service levels and the probability that people will pay to park would affect mode choice.
- The team also used the Short-Range Transportation Evaluation Program (STEP) model to estimate mode shares as a result of implementing different travel and parking strategies in five West Coast metropolitan areas.
- Finally, the researchers used Portland data from 1985 in destination- and mode-choice modeling that they modified so as to include the price of parking at the destination. They then used these data to estimate how variations in transit service levels and parking price would affect mode choice and to compare the modal effect of different parking pricing strategies.

The researchers also undertook several qualitative case studies, including a survey of parking policies in 20 central cities and 11 edge cities; case studies of parking policy in Portland, Oregon, and Midtown Atlanta; and case studies of parking policy within a transportation demand management context at hospitals and universities.

The next section summarizes some of the findings of the empirical research related to mode choice. As the following discussion illustrates, most travel in the United States continues to be made by automobile; however, parking pricing and transit service appear to be important variables in diverting travelers from auto to transit use. This discussion is followed by sections assessing various parking strategies and their effectiveness in increasing transit ridership.

FINDINGS RELATED TO MODE CHOICE

Most work trip travel is made by SOV. The high SOV rates result from a combination of auto-accommodating parking policies and inadequate transit service levels. Cities with restrictive parking practices, including higher parking prices, tend to have better transit service and higher transit ridership rates. Changes in factors related to parking price have a stronger effect on mode choice than do factors related to transit service; however, the most effective means of increasing transit share is by increasing parking price *and* improving transit service. Effects are greatest in the urban core of larger metropolitan areas.

The analysis of the sample from the NPTS confirmed that most work trip travel is made by SOV: 74 percent of the sample's commuters travel by SOV, 12 percent by carpool, 7 percent by transit, and the remaining 7 percent by other modes (mostly walking) (*1*). For more than one-half of the respondents, transit is not conveniently located, with the nearest stop being more than a ¼ mile from their home.

Parking policies in both the 20 central cities and 11 edge cities surveyed continue to emphasize accommodation of the automobile. Only 20 percent of the central cities surveyed place maximums on the amount of parking that new development must provide; only 30 percent of the cities tax parking at a rate higher than 10 percent; and most cities allow stand-alone parking garages to be constructed in the central business district (CBD) without any restrictions or conditions. The average maximum hourly meter rate is $1.18, which is only slightly higher than the average transit fare (*2*). The general lack of restrictive parking policies, along with inadequacies in transit service and/or low densities, explain the fairly high share of SOV and low share of transit for the journey to work.

There were patterns among the 20 central cities and metropolitan areas studied. In general, the researchers found higher transit ridership levels in those cities with higher parking prices and more restrictive parking programs. This finding confirmed other findings of the research team, but because of the wide variation among cities and their circumstances, the researchers could not provide a specific formula for determining which levels of parking price and transit service would result in certain transit mode shares.

The researchers used modeling techniques to answer four basic questions about parking, transit, and travel choices. The following sections address these questions.

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[1] Strathman, J., and Dueker, K. "Transit Service, Parking Charges, and Mode Choice for the Journey to Work: An Analysis of the 1990 NPTS." *Public Transportation,* Vol. 1 (1996), p. 19.

[2] Hartgen, D.T., Segedy, J.A., and Tilley, M.S., "Comparative Performance of Major U.S. Bus Transit Systems: 1988–1994." Center for Interdisciplinary Transportation Studies, University of North Carolina at Charlotte (May 1996).

How Does Parking Price and Transit Service Affect Transit Use in U.S. Cities?

As a measure of transit service, the researchers looked at the percentage of respondents in the NPTS sample who live within ¼ mile of a transit stop ("transit access") and the annual number of transit revenue hours per capita ("transit frequency"). To capture the parking price variable, the team estimated the likelihood that commuters pay for parking if they drive ("pay-to-park probability").

The two transit service variables have an effect on mode share, but the pay-to-park probability has a relatively greater effect. Of the two transit variables, changes in transit frequency have a greater effect on mode share than changes in transit access. The combined effect of changes in both transit frequency and parking price has the greatest effect on mode share.

How Does Parking Price and Transit Service Affect Transit Use for Downtown-Destined Work Trips?

When focusing on trips to the greater downtown area of Portland, Oregon, the researchers confirmed that parking price and transit service levels together strongly influence transit share. For this analysis, the researchers looked at the number of bus lines serving a resident as a measure of transit service. Figure S-1 illustrates the results.

The researchers also found that, based on a monthly parking price of $80, the price elasticity of demand for parking in urban Portland is –.58 with respect to SOV use. This means, for example, that if the monthly price of parking were increased 10 percent—from $80 to $88—the quantity of parking demanded by SOV users in urban Portland would decrease by 5.8 percent. The elasticity of –.58 indicates a greater sensitivity to parking prices in Portland than other researchers have found elsewhere (*3*). The Portland figure likely reflects the fact that the researchers used destination-specific parking data, resulting in less measurement error and avoiding an underestimation of elasticity.

How Does Increasing Parking Price Compare with Other Strategies in Reducing Work Trip SOV Use?

The researchers analyzed data from five West Coast metropolitan areas—Los Angeles, Sacramento, San Diego, San Francisco, and Seattle—to estimate how various types of transportation pricing programs would affect factors such as vehicle miles traveled (VMT), SOV, and regionwide trips. Figure S-2 shows the average percentage change in regionwide SOV trips from four pricing strategies analyzed across the five metropolitan areas.

As is apparent from Figure S-2, the researchers found parking pricing—in this case, a $3-per-day parking charge—to have the greatest effect on SOV work trips. In order to account for variations in density and in the incidence of the parking price, the researchers also modeled a parking charge that varies by location, at $5 in the CBD, $2 in the central city, and $0 in the suburbs. The researchers also controlled for the size of a traveler's city of residence (i.e., small or large), the location of a traveler's residence (i.e., urban core, near core, or suburb), and the level of transit service (i.e., high, medium, or low). Figure S-3 illustrates the results: parking pricing has the greatest effect on the travel behavior of those who reside in the urban core, near core, or suburbs of large cities; its effect is also greatest when transit service levels are high.

[3] Gillen, D.W., "Estimation and Specification of the Effects of Parking Costs on Urban Transport Mode Choice." *Journal of Urban Economics* 4 (1977) pp. 186–199, and Willson, R.W., "Estimating the Travel and Parking Demand Effects of Employer-Paid Parking." *Regional Science and Urban Economics,* Vol. 22 (1992) pp. 133–145.

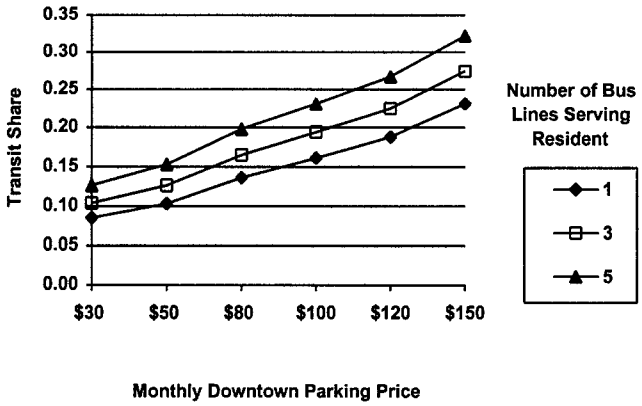


Figure S-1. Transit share, by number of bus lines serving urban resident and monthly downtown parking price.

How Do Different Parking Strategies Compare with One Another in Reducing Work Trip SOV Use?

Using Portland data, the researchers compared the effects of increasing the price of parking, based on a tax on parking revenues; increasing the price of parking, based on a tax on parking spaces; and cashing-out employer-provided parking. Figure S-4 illustrates the effects on transit of these three strategies for the CBD and for the greater Portland metropolitan area.

As is apparent from the illustration, a tax based on parking spaces would have the greatest effect on transit share. Unlike the two other parking strategies, a tax on spaces could be applied throughout an entire region. A tax based on parking revenues would be limited only to areas where parking is already priced—generally the CBD and other high-density locations. Cashing-out would be limited to areas where employers lease, rather than own, parking; again, this is generally in the CBD or in high-density activity centers. Although a parking tax could in theory be applied throughout an entire region, differences in density would have varying effects on how the incidence of the tax is borne: parking providers in high-density areas (such as the CBD) would probably pass the tax on to users, while parking providers in low-density areas (such as the suburbs) would be more likely to absorb the tax.

The estimates shown in Figure S-4 are based on the assumption that the entire parking charge could be passed on to those who park and that the model used to generate these

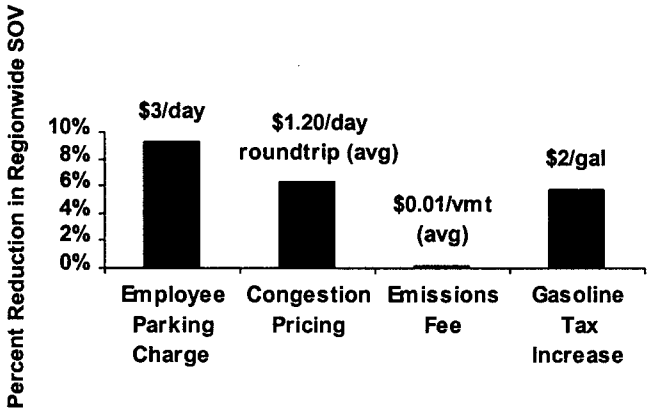


Figure S-2. Average regionwide percentage reduction in SOV work trips.

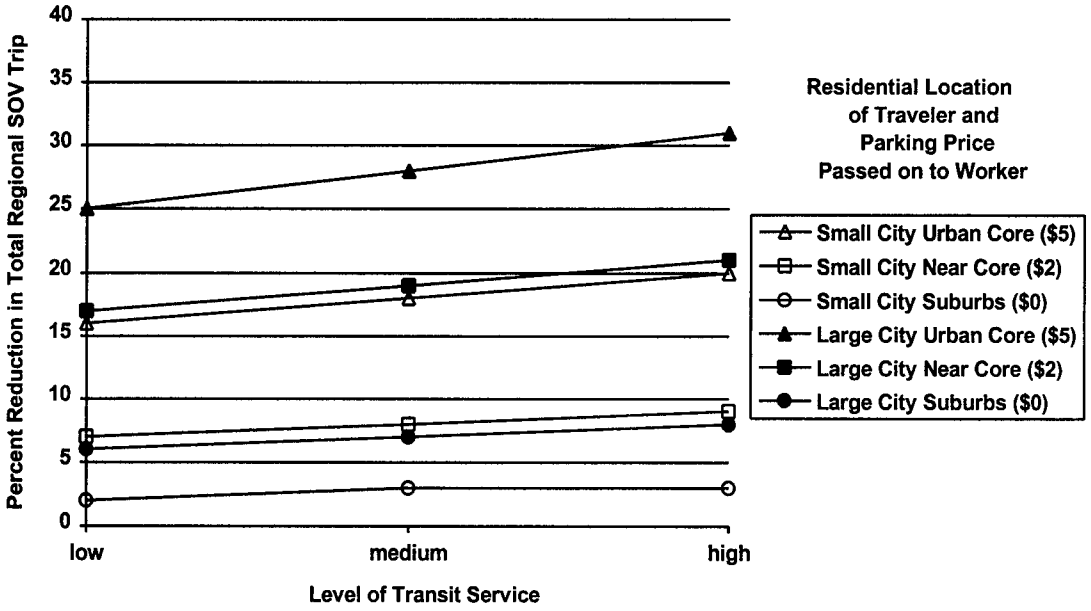


Figure S-3. Reductions in SOV work trips due to variations in transit service and traveler's residence with a graduated parking fee.

estimates works well for suburban locations. This, in fact, may not be the case, given that even the suburban parking variables were based on downtown parking charges. Nevertheless, the relative effectiveness of the three pricing strategies is most likely accurate.

ASSESSMENT OF PARKING STRATEGIES

The team assessed eight parking strategies using five criteria: effectiveness in affecting mode share, scope, political feasibility, efficiency, and ease of administration. In general, no single strategy is both effective and free of implementation difficulties.

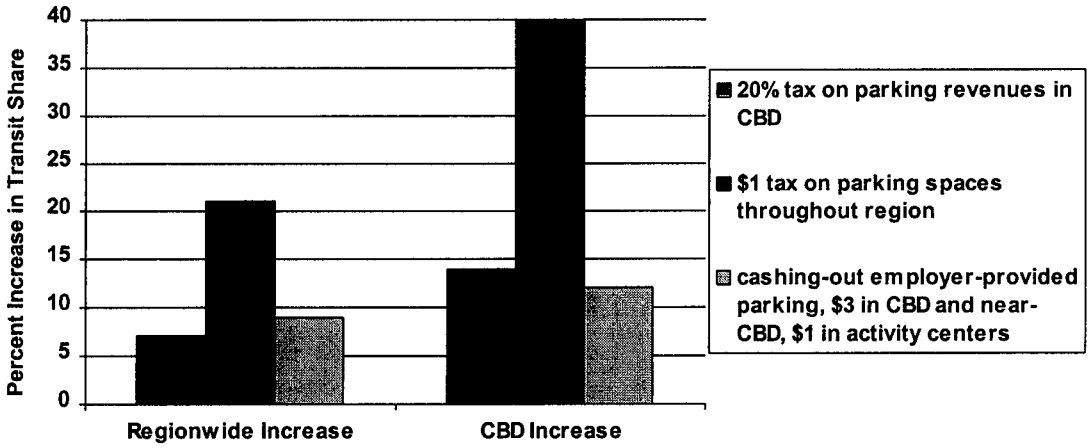


Figure S-4. Increases in Portland home-based work trip transit share, throughout region and within CBD, because of three different parking strategies.

The research team identified five criteria that are important in assessing individual parking strategies. These are effectiveness in increasing transit ridership; scope—that is, how targeted or comprehensive a strategy is in its aim; political feasibility; economic efficiency—which here is defined as how well the strategy corrects negative externalities or whether it generates additional negative externalities; and ease of administration. The team used these five criteria to assess the following parking strategies:

1. Increasing the price of parking, based on a tax on parking revenues;
2. Increasing the price of parking, based on a tax on parking spaces;
3. Cashing-out employer-provided parking;
4. Expanding meters and accompanying residential permit programs;
5. Parking impact fees;
6. Changes in zoning ordinances to restrict parking supply, including
   - Decreased minimum parking requirements,
   - Parking maximums, and
   - Conditional-use permits, e.g., requiring in-lieu fees;
7. Shared parking;
8. Transportation demand management, consisting of
   - Satellite parking-shuttle lots,
   - Preferential parking for carpoolers, and
   - Transit-incentive programs.

Table S-1 shows the result of this assessment. As is apparent from the table, broad strategies, such as increasing the price of parking, based on a tax on parking spaces, have the greatest effect in terms of effectiveness, but have the lowest ratings in terms of political feasibility, efficiency, and ease of administration. Narrow strategies, such as transportation demand management, have low effectiveness ratings but have higher ratings in terms of political feasibility, efficiency, and ease of administration.

DISCUSSION OF EXAMPLES

Two pricing strategies were of particular interest to the researchers: increasing the price of parking, based on a tax on parking revenues, and increasing the price of parking, based on a tax on parking spaces. This section discusses these two strategies as examples of the assessment of price-based strategies, while the next section examines two nonprice-based strategies.

Increasing the Price of Parking, Based on a Tax on Parking Revenues

This strategy would apply to parking that is already priced, i.e., where revenues are already being realized—typically higher density areas, such as the CBD. The researchers assessed this strategy as follows:

- Effectiveness: *moderate*
  The modeling revealed that a 20-percent tax on parking revenues would result in a 7-percent increase in transit ridership for home-based trips regionwide (in the Portland metropolitan area).
- Scope: *narrow spatial scope*
  This strategy would apply only where parking is already priced; it would probably not extend, for instance, to the suburbs and other low-density areas.

TABLE S-1 Assessment of individual parking strategies

Strategy	Effectiveness	Scope	Political feasibility	Efficiency	Ease of administration
Increasing the price of parking, based on a tax on revenues	Moderate	*temporal*: broad *functional*: moderate-narrow *spatial*: moderate-narrow	Moderate	Low to moderate	Moderate to high
Increasing the price of parking, based on a tax on parking spaces	High in CBD with good transit service; lowest in suburban business districts or where transit service is low	*temporal*: broad *functional*: broad *spatial*: broad	Low	Low	Low
Cashing-out employer provided parking	Moderate	*temporal*: narrow *functional*: narrow *spatial*: narrow	Moderate	Moderate	Moderate
Expanding meters and accompanying residential permit programs	Low to moderate	*temporal*: broad *functional*: moderate-narrow *spatial*: narrow	Moderate	Moderate to high	Low to moderate
Parking impact fees	Very low in short term; somewhat greater in long term	*temporal*: broad *functional*: broad *spatial*: narrow	Moderate to high	Low to moderate	Moderate
Changes in zoning ordinances to restrict parking supply: • **Decreased minimums** • **Parking maximums** • **Conditional-use permits**	Very low in short term; somewhat greater in long term	*temporal*: broad *functional*: broad *spatial*: narrow	Moderate to high	Low to moderate	Moderate
Shared parking	Low	*temporal*: broad *functional*: broad *spatial*: narrow	Moderate to high	Moderate	Low to moderate
TDM: • **Satellite parking-shuttle lots** • **Preferential parking for carpoolers** • **Transit-incentive programs**	Low to moderate	*temporal*: narrow *functional*: narrow *spatial*: narrow	High	Moderate to high, unless high subsidies are required	Low to moderate

- Political feasibility: *moderate*
  Those hurt by this strategy would include interest groups and stakeholders who would be hurt by any pricing strategy—low-income travelers, for instance, and retailers. Those made better off would include groups who would benefit from slight reductions in congestion and pollution as a result of the decrease in SOV trips.
- Economic efficiency: *low to moderate*
  Although this strategy does add pricing to the transportation market, it does so on a limited basis. In addition, spillover parking into nearby residential neighborhoods may result if drivers seek to avoid paying the parking price.
- Implementability: *moderate to high*
  Given that a transaction is already occurring when drivers pay to park, adding this tax would not require new mechanisms or institutions.

On balance, this strategy, if implemented alone, is too limited. Because it applies only to those parking in high-density areas where parking is priced, its moderate effectiveness may not be worth the political and efficiency tradeoffs.

Increasing the Price of Parking, Based on a Tax on Parking Spaces

This strategy would apply throughout a region, not just where parking is already priced. Thus, this strategy would impose a tax on parking spaces in the suburbs as well as in the central city. The assessment of this strategy is as follows:

- Effectiveness: *high*
  The modeling revealed that a $1 surcharge would have a 22-percent increase in transit ridership for home-based work trips, regionwide.
- Scope: *broad*
  This strategy may be thought of as a "blunt instrument," because it would affect all drivers, all times, all trip types, and all areas.
- Political feasibility: *low*
  Imposing a tax on parking spaces would affect an even broader group of stakeholders than would the tax on revenues. A much larger constituency of stakeholders would be likely to consider themselves made "worse off" by this strategy.
- Economic efficiency: *low*
  There is a question as to what kind of short- and long-term spatial inequities might result from a strategy such as this. The abundant supply of free on-street parking in low-density areas makes it unlikely that those who park in such areas will have to bear the burden of a parking tax, which would instead be borne by the parking provider. The differences in how the tax is borne in low-density and high-density areas might fuel decentralization tendencies over the long term, as the low-density areas appear more attractive to businesses and employees. Spillover parking in the short term is also a concern.
- Implementability: *low*
  This strategy would require not only a new tax, but sophisticated and complex assessment and administration mechanisms for implementation.

On balance, this strategy, if implemented alone, is too broad and impractical. Although its effectiveness may be very high, the political and efficiency costs would make this strategy exceedingly difficult to implement.

Table S-1 summarizes these two examples, as well as the assessment of the other price-based strategies. It also summarizes the nonprice-based strategies, two examples of which are discussed next.

Changes in Zoning Ordinances

The researchers considered three types of changes in zoning ordinances—decreasing minimum parking requirements (reducing the minimum number of parking spaces required per square feet of development), imposing parking maximums (limiting the amount of parking a developer may supply), and conditional-use permits (permits for building new parking that impose conditions such as a required percentage of carpool spaces). This example focuses on decreasing minimum parking requirements.

- Effectiveness: *low*
  The research team does not expect this strategy to have much effect on transit ridership in the short term, although the long-term effects might be more significant.
- Scope: *narrow spatial scope*
  This strategy would apply only to areas of new growth, such as the suburbs; thus, its spatial scope would be limited to just those areas.
- Political feasibility: *moderate to high*
  Given that no one would have to pay a charge under this strategy, its political acceptability is likely to be fairly high; in addition, developers would be saved the cost of having to provide large amounts of parking.
- Economic efficiency: *low to moderate*
  One concern is that the decreased amount of parking provided would end up in the long term to be inadequate, thus encouraging spillover parking. This would detract from the economic efficiency of this strategy, as does the fact that this is not as direct a means of influencing behavior as is pricing.
- Implementability: *moderate*
  Permitting lower minimums may compel the city to enforce parking providers' compliance with alternative requirements, such as provision of a higher percentage of carpool spaces.

On balance, because this strategy affects only the supply of and not demand for parking, it is too indirect a means of influencing travel behavior. Changes in zoning ordinances alone may have only a minor effect on the quantity of parking spaces supplied and the subsequent price. One type of zoning-ordinance change—e.g., a reduction in the minimum number of spaces required—may need to be complemented by another ordinance change—e.g., imposition of parking maximum ratios—in order to have any appreciable effect on parking supply.

Shared Parking

This program allows two or more adjacent land uses with different peaking characteristics to share the same parking supply. Examples might be a dinner restaurant and a daycare center. The team's assessment of this strategy is as follows:

- Effectiveness: *none*
  This strategy would have no *direct* effect on transit ridership. However, it may promote denser development as firms cluster closer together in order to take advantage of the program. This high density may serve to enhance transit ridership over the long term.
- Scope: *broad temporal and functional; narrow spatial*
  Shared parking does not target any particular trip times or trip types, thus making its temporal and functional scopes broad. It would, however, be narrow in spatial scope, because it would be limited to the specific firms participating.

- Political feasibility: *moderate to high*
  Like changes in zoning ordinances, shared parking does not result in pricing for travelers, and, hence, its political feasibility is quite high.
- Economic efficiency: *moderate*
  On the one hand, this strategy may correct inefficiencies in terms of excess parking supply, but on the other, it may result in undersupply (and hence, spillover parking) over the long term.
- Implementability: *low to moderate*
  Where currently implemented, shared parking requires a lengthy and complex application process. In addition, not all adjacent land users need to participate; only those simultaneously undergoing a development proposal review process can be required to share parking. Thus, this strategy works best in a mixed-use, single-developer situation.

On balance, this strategy, while having a lot of potential in terms of land use policy, has limited potential for affecting mode choice.

CONCLUSIONS

This section outlines examples of an evaluation of four of the eight strategies the researchers examined (see the main report for a full discussion of all eight strategies). As Table S-1 and the examples above demonstrate, no single strategy is effective and free of implementation difficulties. This conclusion led the research team to develop the concept of the "combination approach" to parking policy, discussed in the next section.

THE COMBINATION APPROACH TO PARKING

Because no single strategy is both effective and politically acceptable, the researchers recommend the "combination approach" to parking policy. Six combinations are identified and defined: the parking market combination, the cashing-out combination, the special generator combination, the new growth combination, the commercial district combination, and the residential district combination.

The combination approach to parking involves groups of parking programs that are targeted toward specific locations and problem sets. It recognizes that various combinations are necessary to address different parking and transportation problems throughout a region: one size does not fit all! This approach emphasizes the importance of revenue-producing strategies to fund mechanisms for compensating those made worse off, and it stresses transit improvements as a crucial component of any parking combination package: not only does this enhance political feasibility, but, clearly, travelers need alternatives if they are diverted from the auto. Finally, this approach recognizes that complementary approaches are needed so that, for instance, a strategy that produces spillover parking is complemented by one that addresses spillover parking. The research team devised six parking combinations:

1. The parking market combination,
2. The cashing-out combination,
3. The special generator combination,
4. The new growth combination,
5. The commercial district combination, and
6. The residential combination.

DISCUSSION OF COMBINATIONS

This section provides an overview of some of the salient features of each of the six combinations. Table S-2 provides a summary of the combinations in terms of their component elements, the policy goals to which they are directed, and the specific problem contexts for which they are tailored.

The Parking Market Combination

The goal of this combination is to encourage transit ridership through the implementation of increased parking pricing in high-density, congested areas—primarily CBDs. The key elements include increasing the price of parking, based on a tax on parking revenues; instituting on-street meters and permit zones to address spillover parking as a complementary strategy; financing transportation demand management

TABLE S-2 Combination packages: components, policy goals, and problem contexts

Combination and Components	Policy Goal and Problem Context
Parking Market • Increased parking prices • Cashing-out employer-provided parking • On-street meters and residential permit zones	Encourage transit ridership through explicit parking pricing in areas of congested peak-hour travel and parking
Cashing-Out • Cashing-out employer-provided parking • TDM	Encourage transit ridership by workers who park free in employer-leased parking
Special Generator • TDM • Increased parking prices • Cashing-out employer-provided parking	Encourage transit ridership by employees and users of "special generators": high-density employers with limited parking supply, such as hospitals, universities, and airports
New Growth • Cashing-out employer-provided parking • TDM	Address parking problems and decrease SOV use in suburban activity centers or other noncentral areas of new growth
Commercial District • On-street meters • Shared parking • TDM	Encourage transit ridership through explicit parking pricing in non-CBD commercial areas with parking problems
Residential District • Residential permit zones • On-street meters	Address parking problems in high-density housing areas susceptible to spillover parking from nearby commercial areas

(TDM) programs through revenues, both to enhance political feasibility and to provide alternatives for those who are priced out of SOV travel; enhanced transit service; and a reduction in other taxes—again, to enhance political acceptability.

The Cashing-Out Combination

The goal of the cashing-out combination is to encourage transit ridership among workers who park free in employer-provided parking—typically occurring in high-density areas of concentrated employment. Cashing-out involves the employer providing all employees who are eligible for the free parking with a cash amount equal to the market value of the parking (for this reason, cashing-out as discussed here applies only to leased parking, because it is too difficult to impute a market value to parking that the employer owns; in fact, one feature of a cashing-out program might be to encourage employers to lease parking services, rather than use the spaces they own). The employees can then use the cash to pay for parking, which would then be priced, or they can use it for any other purpose—including transit. Because cashing-out—like most of the strategies—is intended to divert travelers from their autos, suitable alternatives need to be available; hence, an additional element comprising the cashing-out combination would be a strong TDM program.

The Special Generator Combination

Special generators are employment sites that are high density (very high ratio of employees and clientele to land area), with limited parking supply. Examples would be universities, hospitals, and airports. The goal of this combination is to encourage transit ridership by employees of such sites. Key elements include increasing the price of off-street parking by employer actions, as opposed to a tax on revenues or spaces; employer-sponsored TDM programs, such as preferential parking for carpoolers, guaranteed ride home, and reduced-price transit passes; enhancing transit service, to include, for instance, additional or more frequent routes; and possibly a cash-out subsidy.

The New Growth Combination

The goal of this combination is to address parking problems and decrease SOV use in suburban activity centers or other *noncentral* areas of growth. Key features include a parking impact fee, which would be a one-time-only fee that developers would pay and that would presumably encourage them to supply less parking; changes in zoning ordinances, such as lowering minimum parking requirements or imposing maximum ratios; shared parking; and financing of TDM measures, typically through Transportation Management Associations.

The Commercial District Combination

The commercial district combination concept is based on the "benefit district" idea set forth by Donald Shoup (*4*). This combination would be targeted toward increasing

[4] Shoup, D.C., "Cashing in on Curb Parking." *Access*, Vol. 4 (Spring 1994) pp. 20–26.

transit ridership in central city high-density commercial areas outside of the CBD. As in Shoup's formulation, the key to the commercial district combination is the implementation of on-street parking meters, the revenues from which would be used to finance improvements or amenities in the district where the meters are located. The idea is that this funneling back of revenues would enhance the political feasibility of the parking meters. In addition to the parking meters, other elements would include enhanced transit service; shared parking; and permit zones in adjacent residential areas to control spillover parking from the priced streets.

The Residential District Combination

Like the commercial district combination, the residential district combination is predicated on the concept of funneling back meter revenues into the metered district to finance local improvements and amenities. The goal is to address parking problems in high-density housing areas that tend to be susceptible to spillover parking from nearby commercial zones. The two features of this combination are on-street meters and residential permit zones.

CONCLUSIONS

Because no single parking strategy is both effective in terms of diverting auto users to transit *and* politically acceptable and easily implementable, the researchers recommend an approach that employs combinations of parking strategies, targeted toward specific areas and specific problems. The combination approach may also be thought of as a "package" approach, because each combination should include not only several parking strategies, but mechanisms for compensating those made worse off by pricing or restrictive programs, as well as complementary strategies that offset unintended negative consequences, such as spillover parking.

RECOMMENDATIONS

This research has revealed that policy-makers need to identify and address all potential stakeholders in the transportation policy process and make a careful evaluation of the political feasibility of parking—and other transportation—strategies. A consideration of long-term, as well as short-term, effects should be included in this evaluation. In addition, policy-makers need to consider the effect of unintended negative effects, such as spillover parking and the fact that a short-term focus on pricing in the CBD may have an undesirable decentralizing effect.

While the researchers found that parking pricing strategies were among the most effective means of increasing transit share, they also concluded that no single parking strategy is both effective and politically acceptable. If a significant decrease in the predominant mode of travel—SOV—is to occur, policy-makers need to experiment with a "combination" approach to transportation and parking policy. This approach targets specific problems in specific geographic areas; it is likely to be more effective than a broad-sweeping, blunt-instrument approach, such as pricing *all* parking regionwide. It is crucial, however, that such combinations include mechanisms to compensate those made worse off by pricing and regulatory strategies and that they include enhanced transit as a means of accommodating travelers diverted from the auto.

Finally, this research suggests that parking policy be considered in a new light—as part of a region's overall transportation policy, not just an isolated program to address congestion, and as a policy whose implementation may require cooperation among agencies, including city departments of transportation and metropolitan planning organizations, as well as transit agencies, which need to become active participants at the parking policy-making table.

CHAPTER 1

INTRODUCTION AND RESEARCH APPROACH

At rest, the automobile needs three parking spaces in its daily rounds—one at home, one at work, and one in the shopping center.

—Jane Holtz Kay (*1*)

PROBLEM STATEMENT

The purpose of this report is to assess the use of parking policies to increase public transit ridership. Increasing transit ridership has emerged as a goal of policy-makers at all levels of government, as they strive for compliance with federal legislation such as the Clean Air Act Amendments of 1990 (CAAA) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

Both of these pieces of legislation recognize that a primary source of environmental degradation in the latter half of the twentieth century is the growing use of the private automobile. Several policies, alone or in concert, may reduce automobile use by diverting automobile commuters to public transit. These range from land-use policies, such as zoning for higher density and mixed-use developments, to charging commuters for the full cost of private automobile travel through road and parking pricing.

This report focuses on parking strategies as a means of increasing transit ridership for the work trip. For purposes of comparison, this report also considers other strategies to attract automobile commuters to public transportation. The report has three goals:

- To evaluate the *economic efficiency* of parking strategies in terms of correcting deficiencies in the overall transportation market and in targeting those drivers who contribute most to negative externalities of automobile use, such as congestion;
- To assess the *effectiveness* of parking strategies in terms of increasing transit ridership for the work trip; and
- To assess the *political feasibility* of parking strategies in terms of acceptance by different interest groups, equity across income groups and locations, and ease of administration and implementation.

This chapter outlines how the rest of the report addresses these general goals. First, this chapter provides a brief discussion of the historical context of parking problems and policy.

THE HISTORICAL CONTEXT OF PARKING PROBLEMS AND POLICY

The cost and availability of parking are important determinants of private automobile use and of the balance between automobile and transit use. Parking policy also influences development and land use decisions. Policy-makers have made decisions about the role—and regulation—of parking that have varied across different historical conditions. In an effort to place parking policy within a larger policy-making context, this section provides a historic perspective on the "parking problem" and policy-makers' responses thereto (*2*).

Parking in the Pre-World War II Era: Automobile Accommodation and Congestion Relief

When the automobile initially became available to Americans, there was virtually no regulation of its use. Only gradually, as downtown areas became congested with both pedestrians and a multitude of vehicles—streetcars, bicycles, trucks, wagons, and private automobiles—did municipal law begin to prohibit parking during certain times of day in certain areas of the central business district (CBD). Business owners continued to cite downtown congestion as a major problem, but they also were reluctant to embrace more widespread parking restrictions. Municipalities did not begin installing parking meters until the later 1930s, and then only very cautiously, because business leaders continued to oppose strongly measures that might restrict customers' access.

But even parking meters proved inadequate to control downtown congestion. By the 1940s, cities' traffic engineers, police chiefs, and city council members—at that time the primary decision-makers with respect to transportation policy—were advocating additional remedies: street widening and the creation of off-street parking spaces.

[1] Holtz Kay, Jane, *Asphalt Nation: How the Automobile Took Over America, and How We Can Take It Back*, Crown Publishers (1997).

[2] This discussion is based on Bianco, M.J., "Private Profit Versus Public Service: Competing Demands in Urban Transit History and Policy, Portland, Oregon, 1872–1970." Unpublished Ph.D. dissertation. Portland State University (1994). See also (*3*).

Parking During the Interstate Era: Revitalizing the Urban Core

Policy-makers' efforts to alleviate congestion only made matters worse: as street widenings, parking meters, and the construction of off-street parking temporarily alleviated downtown congestion, more automobiles and other vehicles converged on downtown streets. Decentralization of shopping, employment, and residences accompanied—and to a significant extent, resulted from—the large increases in downtown traffic congestion. Beginning in the late 1940s and early 1950s, policy-makers began to look at the downtown parking problem in terms of an urban decline problem. They saw the provision of even more off-street parking as the key to alleviating downtown congestion, thereby making the downtown area more attractive and economically competitive with the growing suburbs.

Beginning in the mid-1940s, cities began to institute parking authorities and other public mechanisms for dealing with the supply of parking. City engineers and other transportation policy-makers during the 1940s and 1950s continued to see street widening, increased off-street parking supply, and the construction of limited-access "super highways" as the answer to congestion and CBD decline.

It was during this period that city zoning ordinances began to include requirements for a minimum number of loading and parking spaces that should accompany new development. In some downtown areas, city engineers and other experts considered street widening to have reached its limits; instead, they began to advocate the complete removal of on-street parking. Transit company officials supported plans that would remove on-street parking—thus facilitating the circulation of their vehicles—but business owners often objected. Although they agreed that traffic circulation might improve, they still were hesitant to support plans that would remove front-door accessibility to their establishments. However, when a 1952 parking ban on 112 blocks of downtown street in Philadelphia increased automobile speeds by 50 percent, the local Chamber of Commerce concluded that the benefits of such a ban outweighed any loss of business or inconvenience to shoppers (*3*).

As highway building proceeded from 1956 on, downtown business interests and policy-makers began to advocate the notion of "parking fields" located just outside the downtown core, but directly off a freeway ramp. Other suggestions for parking provision tied to freeway entrances and exits carried the same motivation: to provide freeway users access to downtown *and* parking, while keeping the downtown streets themselves congestion free.

[3] Levinson, H. S., and Weant, R.A., "Parking and Traffic Congestion: Changing Perspectives." Paper presented at the Transportation Research Board 76th Annual Meeting (January 12–16, 1997) Washington, D.C., p. 4.

Parking in the Era of Multimodal Planning: Holistic Transportation Policy and a Deemphasis of the Auto

By the 1970s, two forces coalesced to drive parking policy: continuing decentralization and central city economic decline and a growing concern with the environment—particularly with compromises in air quality as a result of increasing automobile use. Downtown interests continued to express concern with the former, while federal legislation mandated attention to the latter.

Under pressure to increase downtown accessibility, improve air quality, and decrease automobile use, urban transportation policy-makers began to view parking management as just one element in a larger package of transportation strategies. The focus was on achieving a better balance between automobile use and public transit use. To accomplish this, policy-makers began to consider various parking-management devices: controlling or even "capping" parking supply; instituting park-and-ride facilities for transit users; and implementing preferential parking programs for carpoolers.

By the end of the 1980s, however, it was becoming increasingly apparent to policy-makers that these and other transportation control measures (TCMs) were not having a significant effect on automobile use in general and, from a federal viewpoint, on pollution levels in particular. Thus, policy-makers began to consider additional means of affecting mode choice through transportation demand management (TDM) techniques that emphasized not only incentives for reducing automobile travel, but disincentives for automobile travel as well. The primary disincentive currently under consideration is pricing.

Thus, in the present era, parking management is part of a larger transportation policy that strives to achieve a better balance between transportation modes, while reducing congestion levels, increasing accessibility, and improving air quality. Transportation policy-makers in the 1990s are considering an array of TDM strategies to achieve this objective—including pricing as a disincentive for automobile use. In light of this present goal, this report focuses on parking pricing as a tool to be used, in conjunction with other TDM strategies, to help achieve balance in the transportation system as a whole.

RESEARCH OBJECTIVE

The goal of this report is to analyze the economic efficiency, general effectiveness, and political feasibility of using parking strategies to increase transit ridership. The focus is on the work trip—this being the most amenable to diversion to transit. Although only roughly 26 percent of all trips are work related, travel during the peak constitutes more than 70 percent of transit's patronage (*4*). Therefore, the most signif-

[4] Hu, P.S., and Young, J., *1990 Nationwide Personal Transportation Survey Databook*, Vol. II. Prepared for the Federal Highway Administration (1993).

icant effects on transit use from parking strategies are likely to be observed during the work trip.

Various research sponsored by TCRP examines the issue of increasing transit ridership through various means other than parking policy. These include improvements in transit service levels, manipulation of transit fares, changes in urban form, and TDM strategies. Some of these research projects are listed in Table 1.

ORGANIZATION OF THIS REPORT

To meet the research objectives, the research team used various methods to explore the issues identified in the following report outline:

- **Chapter 1: Introduction and Research Approach.** This chapter contains introductory remarks, provides historical context, and presents the organization of the report.
- **Chapter 2: The Economic Context of Parking Policy.** This chapter presents an overview of the economic context for analyzing parking strategies that involve pricing as a means of increasing transit ridership. One focus of this chapter is on parking pricing as a tool to improve economic efficiency. Another is on the potential long-term effect of parking pricing strategies to encourage decentralization of development.
- **Chapter 3: Travel and Parking Behavior in the United States.** A wide range of parking policies is in place throughout the United States. In the past, researchers have not clearly established the relationship between these policies and travel behavior. To understand this relationship better, the research team interviewed local officials and analyzed travel behavior and mode-choice studies to assess current transportation trends and parking policies in 20 major metropolitan areas. The assessment also includes information regarding trends in noncentral locations, including edge cities (i.e., suburbs with "mini-downtowns" that rival the original downtown).
- **Chapter 4: The Effects of Parking Strategies on Travel Choices.** The focus of this chapter is the effectiveness of transportation strategies in increasing transit ridership. The chapter presents simulation results showing the relationship between parking strategies and mode choice. A comparative study of households in 20 metropolitan areas illustrates how parking price and transit service affect transit use in U.S. cities. Estimates of mode shares for alternate levels of posted parking price and transit service follow, using data from a single metropolitan area (Portland, Oregon).

  Each of these analyses provides a different contribution to this study. The nationwide data provide travel information about the entire United States; however, it is limited to information about the origin of trips and is also fairly general with respect to parking and transit factors. The analysis that uses data from Portland, Oregon, improves on the nationwide analysis by including destination information, as well as more specific information regarding the cost of parking and the availability of transit.

  This chapter also presents the results of two predictive analyses. One of these uses data from Seattle, Los Angeles, San Francisco, Sacramento, and San Diego to assess how increasing parking price compares with other strategies in reducing work trip SOV use. The other employs mode- and destination-choice models using 1985 travel data for Portland to assess how different parking strategies compare with one another in reducing work trip SOV use.
- **Chapter 5: Political Feasibility.** This chapter presents a discussion of the political feasibility of implementing parking strategies. These issues include interest groups and constituencies in the parking policy process, the income incidence of parking policy, political acceptance through the allocation of revenues resulting from pricing strategies, and political acceptance through changing perceptions.
- **Chapter 6: Assessment of Parking Strategies.** This chapter evaluates individual parking strategies with respect to criteria such as effectiveness, political feasibility, economic efficiency, and implementation issues. Information drawn from the following case studies illustrates various implementation issues: a noncentrally located urban development (Midtown Atlanta), a mid-sized city where parking policy has long been

TABLE 1 Examples of other research related to increasing transit ridership

Project Number	Project Name
TCRP A-1	Fare Policies, Structures, and Technologies
TCRP B-4	Cost-Effectiveness of Transportation Demand Management (TDM) Strategies
TCRP H-1	An Evaluation of the Relationships Between Transit and Urban Form
TCRP H-2	Measuring and Valuing Transit Benefits and Disbenefits
TCRP H-4A	Strategies for Influencing Choice of Urban Travel Mode
TCRP H-6	Transit Fare-Pricing Strategy in Regional Transportation Systems

coordinated with transit policy (Portland, Oregon), special generators of parking demand (e.g., universities and hospitals), and several edge cities.

- **Chapter 7: Implementation Guide.** Because no single parking strategy is both effective and politically acceptable, this chapter presents a discussion of six combination parking strategies that policy-makers may implement in certain specific situations.
- **Chapter 8: Conclusions and Recommendations for Further Research.** This final chapter presents the research team's general conclusions and recommendations for further research.

CHAPTER 2

THE ECONOMIC CONTEXT OF PARKING POLICY

People could certainly recognize that offering unlimited access to hearty free meals at restaurants would cause chronic overcrowding there . . . But they fail to connect the congestion they abhor with free access to crowded expressways during peak hours.

—Anthony Downs (5)

INTRODUCTION

Many transportation economists and planners suggest that if Americans paid a higher price for automobile travel, they would not drive as much. This notion is based on the assumption that Americans do not pay the full cost of automobile travel. In an effort to provide a rationale for increasing the price of parking, this chapter summarizes the theory and concepts behind this assumption as it relates to parking. The chapter begins with a brief discussion of some of the research suggesting that increasing the price of parking may indeed increase transit ridership, especially for the journey to work. It then presents the rationale for using parking pricing as an appropriate strategy for reducing automobile travel and for increasing public transit ridership. Finally, this chapter discusses a possible unintended negative effect of parking pricing: differences in geographic incidence that could stimulate decentralization over the long term.

PARKING PRICES AND TRANSIT RIDERSHIP

Although many factors affect mode choice, many analysts have suggested that the price of parking has been a primary factor. Most commuters choose to drive alone because most employee parking is free. Transportation economist John Kain considers the effect of free parking for employees to be so significant that the elimination of employer-paid parking incentives should *precede* consideration of road pricing. He even suggests that eliminating parking subsidies might, in many instances, mitigate the need for road pricing at all (6).

Anthony Downs favors market-priced parking over congestion pricing because it is easier to administer and because it does not pose as much a threat to privacy (1).

Although these analysts and others assume that parking price is an important factor in transportation mode-choice decisions, research on this relationship has not been definitive. For various reasons, it is difficult to assess how policy intervention in parking markets will be transmitted and affect commuters' choices. For example, research has not successfully evaluated the effect of spillover parking (parking diverted, as a result of pricing policies, from one location to another). Research also is not clear about the percentage of drivers who switch from driving alone to carpooling, rather than transit, because of increased parking prices. This suggests that researchers also need to consider how varying levels of transit service interact with parking prices. Another major problem is that researchers have collected parking price data only from those who currently drive. There is insufficient data on the parking prices faced by those traveling by another mode; thus, researchers have not been able to estimate how parking pricing may affect those travelers.

Despite these difficulties, research continues to suggest a link between the price of parking and transit ridership. The San Francisco County Transportation Authority, for example, conducted a 1995 travel behavior survey and found that, when parking costs exceed transit fares by 20 to 30 percent, commuters tend to take transit rather than drive alone. The survey revealed that 47 percent of the employees who drove alone reported that they either park free or are provided employer-paid parking. Only 11.5 percent of the employees who took transit indicated that they would have free or employer-paid parking (7).

THE COSTS OF PARKING

This section summarizes recent literature with respect to the cost of parking; this information is also presented in Table 2.

John Pucher concludes that "roughly 90 percent of customer and employee parking in the U.S. is provided free of

[5] Downs, A., *Stuck in Traffic: Coping with Peak-Hour Congestion*. The Brookings Institution and the Lincoln Institute of Land Policy (1992).

[6] Kain, J., "Impacts of Congestion Pricing on Transit and Carpool Demand and Supply." In National Research Council, Transportation Research Board, Committee for Study on Urban Transportation Congestion Pricing, *Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion*, Vol. 2. National Academy Press (1994) pp. 502–553.

[7] "San Francisco Survey Establishes Relationship Between Transit Usage, Parking Cost, and Transit Fares." *The Urban Transportation Monitor* 10 (June 7, 1996) pp. 1, 5.

TABLE 2 Parking costs—comparison of research

Study	Delucchi	Pucher	Beshers	Hanson	Mackenzie, et al.
Cost					
Nonresidential off-street parking	Treats as included in the price of goods and services or offered as an employee benefit	Treats as subsidized	Treats as included in the price of goods and services or offered as an employee benefit	Treats as infrastructure cost: supported by both public funds and user fees	Market cost, 85% not borne by drivers
Home garages and other residential parking	Treats as included in the price of housing	***	***	***	***
On-street nonmetered parking (residential and nonresidential)	Treats as public infrastructure or service cost	*All* unpriced spaces are inefficient and should be priced	Not appropriate to price curbside spaces in low-density residential neighborhoods	***	***
Municipal off-street parking not priced at marginal costs	Treats as public infrastructure or service cost	Should be priced at commercial rates	***	***	***

*** Not treated separately

charge to auto drivers" (*8*). Pucher's estimate is based on that made by MacKenzie, Dower, and Chen in their recent work, *The Going Rate: What It Really Costs to Drive* (*9*). Likewise, Shoup and Pickrell note that 93 percent of U.S. auto commuters park free (*10*). These authors conclude that a very large percentage of parking is free to users and that employers or retailers generally subsidize the portion of the cost that the auto driver does not pay.

An alternate view is that employee and customer parking is not "free," that is, that employers and retailers do not subsidize it, but that they instead bundle parking as part of a benefit and wage package to employees or in the price of goods and services to customers. This position, which both Mark Delucchi and Eric Beshers hold, maintains that users in fact do pay for most parking, *indirectly* if not directly (*11*). Mark Hanson also seems inclined toward this opinion, indicating that a combination of public funds and user fees pay for most nonresidential off-street parking (*12*).

There are also varying opinions regarding forms of parking other than employer or retailer parking. Delucchi is the only one of these authors to discuss residential parking, and, as with nonresidential parking, he concludes that this, too, is not free, but instead is bundled in the price of the housing or rent. Thus, he maintains that users pay for residential parking indirectly as part of their housing costs.

None of these authors discusses on-street nonmetered spaces at great length. Delucchi treats these spaces as bundled in the public infrastructure and thus paid for through taxes and fees. He also presents the fullest—although still brief—discussion of municipal off-street parking that providers price below the going market rate, noting that this parking, too, is a public infrastructure and service cost. The implication is that, although providers do not price on-street nonmetered parking and municipal parking at market rates, users nevertheless pay for them through taxes and other fees. One might argue that that amounts to a government subsidy, but the implication in Delucchi's work is that even taxes and user fees are a form of payment.

The most important conclusion of authors like Delucchi and Beshers, one emphasized by Charles Rivers Associates, is that employee and customer parking is not in fact free, but that employers and retailers bundle it in the prices of goods and services (*13*). Although employees and customers do not pay directly for the parking, they do benefit directly from its provision, because they take advantage of parking in the spaces provided.

The conclusion of authors such as Delucchi and Beshers—that users pay for nearly all parking either directly or indirectly—suggests that there may be little economic rationale for implementing additional parking pricing strategies. Authors such as MacKenzie et al., Pucher, and Shoup and

[8] Pucher, J., "Social and Environmental Costs of Automobile Driving." *Passenger Transport* (November 8, 1993) p. 5.

[9] MacKenzie, J.J., Dower, R.C., and Chen, D.D.T., *The Going Rate: What It Really Costs to Drive*. World Resources Institute (1992).

[10] Shoup, D., and Pickrell, D., *Free Parking as a Transportation Problem*, Department of Transportation (1980).

[11] Delucchi, M., "Total Cost of Motor-Vehicle Use." *Access*, 8 (Spring 1996) pp. 7–13; Beshers, E.W., *External Costs of Automobile Travel and Appropriate Policy Responses*. Highway Users Foundation (1994) 21 pp.

[12] Hanson, M.E., *Results of Literature Survey and Summary of Findings: The Nature and Magnitude of Social Costs of Urban Roadways Use*. Prepared for the Federal Highway Administration (1992).

[13] Charles River Associates, Inc., *Building Transit Ridership—An Exploration of Transit's Market Share, and the Public Policies That Influence It*, H-4A Final Report, Prepared for the Transit Cooperative Research Program, Transportation Research Board, National Research Council (February 1997), pp. C-9–10.

Pickrell, however, focus only on the *direct* payment of costs by users and conclude that, because users do not pay for most parking directly, there is a strong rationale for implementing parking pricing strategies.

THE RATIONALE FOR PARKING POLICY

Before discussing whether or not policy-makers should consider both direct and indirect payment of parking costs as providing a rationale for policy implementation, this report turns to a discussion of two other factors that may provide a rationale for parking pricing: (1) inadequacies in the tax code and (2) negative externalities and other problems resulting from the provision of parking.

Inadequacies in the Tax Code

Analysts frequently cite the tax treatment of employer-provided parking as a distortion in the private market for parking. The federal government typically taxes compensation that employees receive, except for qualified fringe benefits. Although employees who itemize can often deduct certain expenses associated with their employment, the Internal Revenue Service does not allow any deductions for ordinary commuting to a principal place of employment. When businesses provide employees with a benefit that the federal tax code does not treat as a deductible expense, the code typically considers the value of that benefit as income to the employee. For example, if a business were to provide housing for employees, in most circumstances, the code would treat the rental value of the housing as income to the employee. Most commuting assistance would fall into this category, but the tax code largely exempts taxation of the value of employer-provided parking.

Whenever tax laws make a benefit tax exempt, employees tend to increase the use of that fringe benefit. Most businesses typically provide parking as a free service to employees and customers. Many analysts argue that tax-exempt provision of parking services, but not of transit or other services, induces excess use of automobiles for commuting.

In 1995, employers could provide parking as a tax-exempt fringe benefit up to a maximum cash equivalent of $160 per month (indexed up from $155 per month in 1994) for each employee. The federal government indexes this amount (in $5 increments) annually based on the cost of living (*14*). Although few employers expend this amount for employee parking, the amount they do spend can result in a sizable fringe benefit. Provision of free parking effectively lowers the cost of parking to the employee relative to equivalent payments in cash. The employee would have to receive more than the cash value of the parking to remain as well off since the government would tax the cash, and employees would then have to purchase parking out of after-tax income. Some analysts favor giving the employee a choice between the fringe benefit or the cash; but, as Chapter 6 notes, under federal tax code rules, allowing this option makes the benefit taxable for *all* employees, including those whom employers did not previously provide with free parking.

In 1994, employers could provide tax-exempt transit or vanpool benefits up to $60 per month or $720 per year (*15*), but not as many employers provided this benefit as provided free parking, which was at that time tax exempt up to $155 per month. Some analysts argue that the disparity in the tax-exempt amounts continues to encourage the use of automobiles, even when employers offer both benefits. Others note that transit users pay only a fraction of the cost of providing transit service and that comparison of transportation benefits should include all subsidies to each form of transportation. Although there is some uncertainty about how much the provision of parking as a tax-exempt fringe benefit really does create a distortion, it probably has an effect on some choices, such as the drive-alone or carpool choice, that lead to more use of automobiles than would occur if each commuter paid for parking directly.

Although the issue of taxation relative to employee benefits is an important one, it is important to recognize that drivers make most trips for purposes other than work and that changes in tax treatment for employee parking would not directly affect these trips. For example, expenditures that a business makes to increase customer satisfaction are generally tax deductible. Hence, using the tax code to affect directly the provision of free or subsidized parking for customers would require a major change in tax laws regarding the deductibility of business expenses in order to remove the tax exemption.

Negative Externalities and Other Problems Resulting from the Provision of Parking

In addition to tax code issues, there are several other problems associated with the provision of parking. These include the existence of negative externalities, defined below; the encouragement of surface parking lot construction because of tax incentives; and excessive parking supply resulting from city policies aimed at dealing with spillover parking problems.

Negative Externalities Associated with Parking

A negative externality is a social cost that individuals or groups create but for which they do not pay either directly or

[14] Filler, L., "Federal Tax Benefits for Commuting." *TDM Review*, Vol. 3, No. 2 (June 1995) pp. 11 and 15.

[15] National Research Council, Transportation Research Board, Committee for Study on Urban Transportation Congestion Pricing, *Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion*, Vols. 1 and 2, National Academy Press (1994).

indirectly. Air pollution, for example, is a negative externality resulting from the use of automobiles; it is a social cost automobile users create but for which they do not pay. The provision of parking services may also be associated with certain negative externalities. That is, vendors of parking services may not, in fact, pay the full social cost of providing parking services. Law-enforcement and environmental negative externalities may result from the provision of parking. For example, parking structures are a location for crimes in some communities, generating increased need for public protection services. Surface parking lots also generate oily runoff that may pose environmental or water treatment costs elsewhere in the community. To the extent that vendors of parking services do not bear such external costs through property taxes or other levies, the private cost of providing parking may understate full costs.

Tax Incentives for Surface Parking Lots

Another common argument related to the provision of parking services is that the property tax code favors surface parking lots because it taxes the owners primarily on the value of the land, which is based on the income stream. There is thus an incentive for land owners to convert vacant land to an income-producing use, such as surface parking, that does not have much effect on the tax bill. This incentive may therefore result in an oversupply of parking. Oversupply may, in turn, result in lower parking prices, which, in turn, encourage more automobile use.

City Policies to Control Spillover Parking

Spillover parking is parking that spills over from one area to another—in this case, out on to city streets from parking structures and lots. Many cities have typically managed spillover parking by instituting on-street meters and imposing minimum parking requirements, which set the minimum number of spaces to serve residential, commercial, and industrial uses on land parcels. Zoning ordinances usually express minimum parking requirements as the minimum number of spaces required per dwelling unit, per 1,000 square feet of floor space, or per other unit, such as theater seat. City policy regarding the provision of on-street parking and minimum parking requirements can, however, lead to excessive parking supply. As is the case with tax incentives for surface lots, if excess supply occurs, then the price for parking—whether the users pay for it directly or indirectly—declines, thus encouraging more automobile use. In recognition of excess supply, some jurisdictions impose maximum parking requirements, which limit the number of spaces per unit of building space. Nevertheless, widespread policies to control spillover parking have had a perverse effect on parking pricing by increasing supply and hence lowering the price.

THE GEOGRAPHIC INCIDENCE OF PARKING POLICY

OBITUARY

Downtown Business District of City X, last surviving member of a family of City Downtown Business districts, died yesterday in the City of X, a one-time prominent member of the community.

He suffered an increasing paralysis due to the congestion of his main arteries of travel. Doctors worked over him with increasing vigor during the last days of his life, but the disease had become so acute that little relief was possible. Injections of policy regulations, parking meter pills, and traffic plan treatments seemed to instill new life in this venerable old gentleman of the city. However, long-term treatment and major surgery was necessary if the patient was to survive. Before the surgeons could agree upon the type of anesthetic, outlying shopping centers developed, complications of attractive free parking space at the outlying shopping centers caused undue pressure on the competition, and the patient died (16).

The preceding section indicates that there are compelling policy and economic justifications for parking pricing. As the quotation above suggests, however, a potentially significant negative externality that might result over the long term because of variations in density and the incidence of pricing policy throughout a geographic region. This potentially severe long-term negative externality is hastened decentralization, as "outlying centers" become increasingly attractive because of restrictive parking policies in the downtown area.

Decentralization has characterized urban development for more than half a century. Many analysts consider decentralization, in its historical and present form, to be undesirable. They believe that urban sprawl has negative effects on the environment—including increased vehicle miles traveled (VMT)—and divisive effects on the urban social fabric, particularly in terms of widening the gulf between racial and income groups. Also, decentralization can adversely affect transit, by reducing the urban densities necessary to sustain transit service.

Although parking pricing and restrictions may reduce downtown congestion and enhance the accessibility and attractiveness of the CBD in the short term, long-term effects may reinforce decentralization (*17*). If, for example, parking is priced or supply is restricted by regulation in the CBD, downtown employers and retailers may move to the suburbs, where parking supply is plentiful and free. Decentralization is encouraged, because people are more likely to choose to work and shop where parking costs are lowest—the suburbs.

[16] "Bus Transportation in Downtown Portland," December 1952 pamphlet, cited as appearing in a legal bulletin of the New York State Conference of Mayors.

[17] See Segelhorst, E.W., and Kirkus, L.D., "Parking Bias in Transit Choice." *Journal of Transport Economics and Policy*, Vol. 7 (1973) pp. 58–70; and Hamerslag, R., Fricker, J.D., and Van Beck, P., "Parking Restrictions in Employment Centers: Implications for Public Transport and Land Use." Paper presented at the 74th Annual Meeting of the Transportation Research Board, Washington, D.C. (1995).

In economic terms, the reason that parking prices may rise more in the central city than in the suburbs is because of variations in incidence. Incidence refers to who bears the burden of a tax or a price. The incidence of many strategies may not be borne by the intended party—thus resulting in unintended effects.

The incidence of a pricing policy—such as regulated rates or a tax on parking spaces—is determined by the price elasticity of demand and supply of the commodity in question (parking). Price elasticity refers to the percent change in quantity demanded or supplied as a result of a 1-percent change in the price of the good. Price elasticity tends to be greater when there are good substitutes; in the case of spillover parking, for instance, on-street spaces can be substituted for off-street spaces. In terms of elasticity of demand, in high-density areas, such as the CBD, where *on-street* parking is not readily available and is likely to be priced, the demand for *off-street* parking is not very flexible with respect to price. On the other hand, in low-density areas, such as the suburbs, where the supply of on-street parking is ample, demand for off-street parking is elastic—or flexible—with respect to price. Thus, in these areas, suppliers of parking will bear most or all of the incidence of a tax on off-street parking.

Downtown parking providers often price their parking supply because supply and demand characteristics lead to a price that is high relative to the cost of collecting the parking fee and enforcing restrictions. In many suburbs, incidence effects result in a price that would be too small to warrant parking providers' expenditures of resources on collection and enforcement. Further, different types of parking policies could have differential effects between the central city and the suburbs. For example, a tax on downtown parking only would be one of the easiest to enforce and collect, but it could have negative long-term effects by making suburban locations seem more attractive.

There are two types of behavior that affect the consequences of a parking policy. In the short term, the behavior of the user determines mode split and spillover effects; but in the long term, the location decisions of businesses are likely to have an important effect, as well. The modeling techniques that the researchers of this report used have been developed for addressing the effect of changes in price on the behavior of the user in the short term only; hence, discussions of long-term effects are more speculative, but potentially very important.

The research team employed a model of user behavior to generate estimates of mode split effects for various changes in costs to the user of parking. These results, which Chapter 4 presents, are the immediate, or short-term, effects. To generate these results, the researchers made assumptions about the ultimate effect of the parking policy on users, and this effect had to be modeled as a price effect. The research team looked at a flat regionwide fee, as well as a differential fee that was graduated downward with distance from the CBD; the differential amounts were meant to account for incidence differences.

As noted, a differential effect may make a suburban location seem more attractive for employers, retailers, and employees, even though better transit service exists in the CBD to provide a substitute for drivers who are priced away from SOV travel. The differential effect may thus stimulate decentralization, although this would occur over the long term.

This discussion recognizes that spatial competition exists between cities and their suburbs. Firms located in the central city have relatively high land and labor costs. However, because these firms benefit from agglomeration economies, are centrally located, and are served by a relatively well-developed transportation network, their production costs are competitive with less centralized locations.

Parking costs are considered to be part of a firm's production costs. Thus, when parking costs increase, total production costs increase. Production costs and travel costs work together to determine the "market area" controlled by a firm. In Figure 1, the egg shapes represent the market areas for a

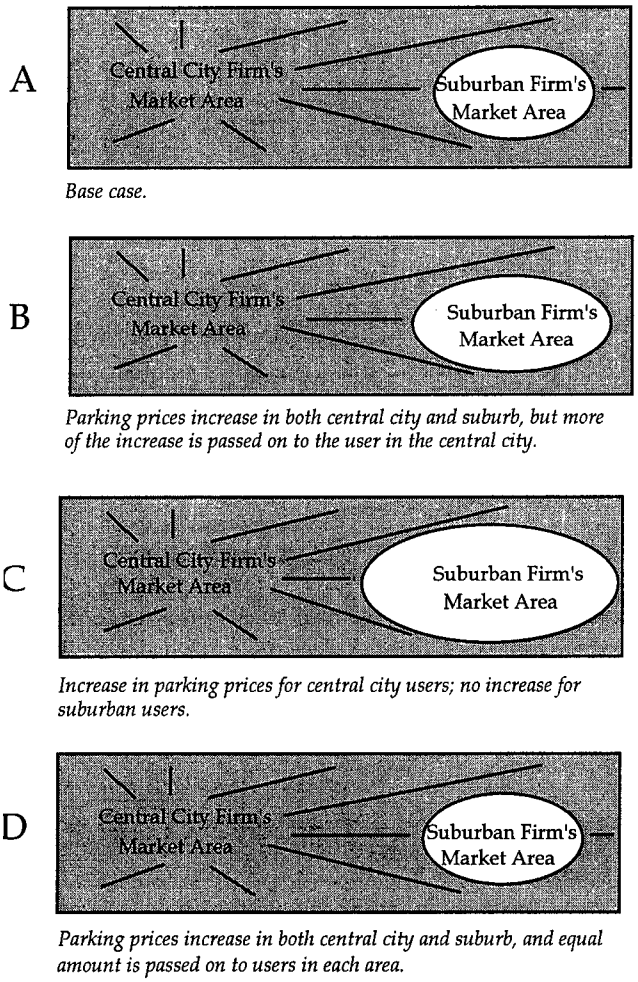


Figure 1. City center and suburban firm market areas, with differing levels of parking prices.

suburban firm, as determined by the production and travel costs under four different scenarios (*18*). The central city firm's market area is represented by the entire gray portion; in each case, the central city firm's market is larger than the suburban firm's. But, as described below, the extent of the suburban firm's market area changes relative to parking prices.

Scenario A in Figure 1 is the base case. Here, the central city firm—with its higher production costs and lower travel costs—has a larger market area than does the suburban firm. In Scenario B, parking prices are increased for both the central city firm and the suburban firm; however, the increase in price as passed on to the suburban user is less than the increase in price for the central city user. For instance, parking prices for the central city parker might increase by a certain daily amount, but the suburban parker may pay only a fraction of this daily increase. The differences in price paid are determined not only by the particular strategy implemented, but by local conditions with respect to the availability of on-street parking and other factors that may affect incidence. This differential increase in prices paid by the user results over the long term in a slightly larger market area for the suburban firm.

In Scenario C, parking prices are increased for the central city firm only. This would be the effect of a parking pricing policy that resulted in increased prices being passed on to the commuters in the central city, but not in the suburbs. As is clear from Figure 1, in this situation, the suburban firm gains a substantial share of the market, with the central city firm losing market area by a corresponding amount.

The final case, Scenario D, is one in which the parking price passed on to the user is increased by exactly the same amount for both central city and suburban locations. As is apparent, the effect on market areas is nil, and the illustration is exactly the same as in the base case, Scenario A.

Both Scenario B and C, in which parking prices increase by a greater rate in the central city than in the suburbs, are clearly advantageous to the suburban firms and disadvantageous to the central city firms. The resulting increase in the suburban firms' market area as a result of increasing central city parking prices helps explain why some firms would choose to move to a suburban location. Thus, increased decentralization is a very real potential consequence of increasing parking prices, but the effect would occur over the long term, because it would take time for firms to relocate.

Finally, decentralization can adversely affect transit because high levels of transit service depend on sufficient levels of population and employment density. If decentralization is exacerbated by parking policies, the result may be decreased urban densities; these, in turn, result in decreased transit service and corresponding declines in transit use—the positive short-term effects of parking pricing on transit use may, therefore, be negated over the long term.

[18] See Hoover, E.M., and Giarratani, F. *An Introduction to Regional Economics*. Alfred A. Knopf (1984) pp. 78-90.

Many strategies, however, would not have a decentralizing effect. As suggested by Figure 1, if policy-makers increased parking prices by a flat amount across the region (e.g., by regulation rather than a tax), high-density areas would not be at a disadvantage vis-à-vis the suburbs. In fact, the superior transit service found in the CBD and other high-density locations might attract firms, employees, and residents, and thus have a *centralizing* effect over the long term.

CHAPTER SUMMARY AND CONCLUSIONS

This report maintains that parking pricing is justified as a policy response to overuse of the automobile, because, through pricing, users pay *directly* for parking and thus are more likely to connect the costs of parking with their travel behavior. In addition, a policy of parking pricing indirectly mitigates distortions—such as congestion and other negative externalities—in the travel market in general.

As an earlier section discussed, analysts disagree about whether users pay for most of the costs of parking. These analysts' disagreement is rooted in whether they assume that users are paying for costs *directly* or *indirectly*. Those who focus on direct payment of costs conclude that users do not pay for most of the cost of parking, while those who consider both direct and indirect payments conclude that users do pay for most costs.

Even if it is true that users pay for nearly all parking indirectly as a result of the bundling of parking prices in wage and benefit packages and in the price of goods, services, and housing, some people still argue that problems remain, as discussed above: automobile use is excessive; the tax code is inadequate; and negative externalities, such as congestion and automobile emissions, continue.

Those who argue that users pay for most of the costs of parking either directly or indirectly may conclude that there is little economic rationale for additional intervention into parking markets. To economists, indirect payments do not amount to a market distortion and thus do not warrant market intervention or regulation of parking. From the economists' point of view, the only economic justification for policy changes is that policy-makers need to make some changes to correct tax problems, negative externalities, and inefficient city parking policies. From this perspective, parking taxes or regulatory strategies may not, however, be appropriate policy changes; changing city policies with respect to parking supply, for instance, may be more effective.

Although it may be difficult to provide a *strictly economic* rationale for parking market intervention, it is easier to provide a *general policy* rationale. First, even if it is true that users pay for most of the cost of parking, they pay for much of this cost *indirectly*, and indirect payments are not as effective marginal pricing mechanisms as direct payments. That is, shoppers are probably not aware that the price of goods and services includes parking; they probably do not take that into consideration in their travel mode decision-making. Likewise, employ-

ees are probably not aware that their free parking is part of their wage and benefit package, and they, therefore, do not take that into consideration when deciding whether to drive to work. The effect of the indirect payment of parking costs is that users do not consider the price in their mode decision. The result is that more people drive than would be the case if policy-makers implemented market-based parking policies that could achieve more explicit, direct pricing of parking.

A second policy rationale for parking market intervention is that even if the market for parking operates efficiently in isolation, with indirect or direct payments offsetting nearly all costs, problems in the rest of the transportation market may justify the use of parking policy. Most analysts agree that negative externalities distort the market for other urban transportation services, particularly congestion, pollution, and accidents for which the responsible party does not pay. Remedies for these negative externalities include congestion pricing, emissions fees, and insurance and tort reform. However, if policy-makers cannot implement remedies for these market failures because of technological or other problems, it is possible that parking pricing policy could offset, at least partially, the imbalance these other distortions create. In particular, the use of parking policy to stimulate transit use may help restore balance to the overall transportation market.

In summary, the perspective that the indirect payment of parking costs does not provide for effective marginal pricing and that there are distortions elsewhere in the transportation system provides the primary justification for implementing parking pricing policy—parking pricing policy is (1) an effective means of connecting costs and behavior and (2) a second-best remedy for distortions that other market failures create.

Although parking pricing may be justified from a policy and even an economic perspective, it is not necessarily without negative externalities. Analysts have rarely commented on differences in the geographic incidence of pricing strategies. This chapter argues that, because of supply and demand characteristics, parking is more likely to be priced in high-density areas (e.g., the CBD) than in low-density areas (e.g., the suburbs). The chapter further argues that because of this differential, suburban locations may appear more attractive to employers, retailers, and employees. Thus, higher parking prices may cause firms and employees to relocate to the suburbs, despite the higher quality of transit service existing in the CBD. Although this decentralization would occur over the long term, it could have serious consequences for transit, which depends on high densities to support high service levels.

CHAPTER 3

TRAVEL AND PARKING BEHAVIOR IN THE UNITED STATES

[P]arking policies are based on two assumptions, especially at suburban sites: that enough spaces will be supplied to meet the highest demand, and that drivers will park for free.

—Lisa Wormser (*19*)

INTRODUCTION

Although travel behavior is similar from city to city, there is considerable variation in travel patterns because of size, topography, and historical development patterns. This variation suggests that a given parking strategy may not be appropriate in all locations. In recognition of the variation in both the extent of present implementation of parking programs and the complex nature of travel behavior, this chapter develops a general overview of travel and parking interrelationships in the United States by discussing the following

- *The status of work trip travel and parking in the United States.* The researchers assessed the nature of work trip travel, transit service, parking policies, and other relevant factors in the United States in order to provide a contextual background for analyzing the strategies that this report presents in later chapters.
- *The relationship of current parking programs and transit ridership and service levels in U.S. cities.* Because the research on the relationship between parking programs and levels of transit service and ridership is not definitive, the research team sought to supplement the limited evidence by analyzing the relationship between those programs and levels of transit service and ridership.
- *The nature of travel and parking activity in edge cities and other noncentral locations.* Most of the information about trip-making, parking policies, and the relationship between the two is limited to central city data. The team sought to supplement these data with similar information from areas of new development in locations outside of the CBD and outside of the central city. The goal was to provide a more comprehensive picture of the present relationship between parking programs and transit use.

[19] Wormser, L., "Don't Even Think of Parking Here." *Planning* (July 1997).

THE STATUS OF WORK TRIP TRAVEL AND PARKING IN THE UNITED STATES

Introduction

This section presents an overview of the nature of work trip travel, transit service levels, and parking programs in place in 20 metropolitan areas throughout the United States. Tables 2, 3 and 4 summarize this information. The purpose of this section is to provide a background for the discussion of particular parking strategies later in this report.

The research team conducted two studies to assess the current state of work trip travel, transit service, parking policies, and other factors across the United States. The first of these studies looked at work trip travel, transit service, and pay-to-park probability, using data from a sample of the 20 consolidated metropolitan areas chosen for the 1990 Nationwide Personal Transportation Survey (NPTS) (*20*), augmented with data from the Federal Urban Mass Transportation Administration (*21*) and congestion estimates calculated by the Texas Transportation Institute (*22*). In the second study, the team surveyed officials across the United States regarding parking policies currently in place.

Work Trip Travel Behavior, Transit Service, and Pay-to-Park Probability

This section presents the salient findings of an analysis of work trip travel mode, transit service levels, and pay-to-park probability (i.e., the likelihood that auto commuters pay for parking). This analysis was based on the NPTS sample. The findings, which Tables 3 and 4 summarize, are as follows:

- Single-occupancy vehicle (SOV) travel accounts for most (74 percent) of the commute trips in the NPTS 20 con-

[20] Vincent, M.J., Keyes, M.A., and Reed, M., *NPTS Urban Travel Patterns: 1990 Nationwide Personal Transportation Survey.* U.S. Department of Transportation, Federal Highway Administration, Office of Highway Information Management (1994).

[21] U.S. Department of Transportation, Urban Mass Transportation Administration, *Transit Profiles: Agencies in Urbanized Areas Exceeding 200,000 Population.* 1990 Section 15 Report (1990).

[22] Schrank, D.L., Turner, S.M., and Lomax, T.J., *Estimates of Urban Roadway Congestion—1990.* Research Report 1131-5, Texas Transportation Institute, Texas A&M University (1993), 61 pp.

TABLE 3 Travel and other characteristics for metropolitan areas grouped according to mean transit rank

Metropolitan Area	Mean Transit Rank[A]	Transit Share (Pct)[B]	SOV Share (Pct)[B]	Carpool Share (Pct)[B]	Percent within 1/4 Mile Transit Access[C]	Annual Transit Revenue Hours Per Capita[D]	Percent Complex Trips[C]	Annual Congestion Costs Per Traveler[E]	1994 Central City Population[F]	Percent Change in Central City Population, 1980-1990[F]
High-Transit Cities										
San Francisco	3.0	9.3	69.8	13.0	60.1	2.1	41.8	$760	734,676	6.6
New York	3.3	27.8	52.3	10.3	46.0	2.7	64.2	$390	7,333,253	3.5
Chicago	4.7	13.7	67.5	12.0	47.1	1.8	38.4	$300	2,731,743	-7.4
Boston	5.0	10.6	70.2	10.3	46.4	1.5	42.3	$495	547,725	2.0
Seattle	6.3	6.3	73.8	12.0	53.1	1.3	39.8	$660	520,947	4.5
Philadelphia	6.3	10.2	69.2	12.2	39.7	1.4	36.6	$270	1,524,249	-6.1
Portland	7.3	5.4	74.1	12.3	50.0	1.4	31.8	$330	450,777	18.8
Mean	**5.1**	**11.9**	**68.1**	**11.7**	**48.9**	**1.7**	**42.1**	**$458**	**1,977,624**	**3.1**
Medium-Transit Cities										
Los Angeles	8.0	4.6	72.9	15.5	49.9	.9	39.6	$670	3,448,613	17.4
Buffalo	8.3	4.7	77.1	11.2	58.3	1.0	41.7	$380	312,965	-8.3
Pittsburgh	8.3	8.0	71.5	12.8	36.7	2.0	35.4	$270	358,883	-12.8
Denver	9.0	4.3	75.0	12.4	53.8	1.0	33.3	$370	493,559	-5.1
Miami	11.0	4.4	75.5	14.5	43.2	1.3	36.5	$520	373,024	3.4
Milwaukee	13.7	4.9	77.3	10.9	26.2	1.5	27.9	$160	6,174,044	-1.3
Mean	**9.7**	**5.2**	**74.9**	**12.9**	**44.7**	**1.3**	**35.7**	**$395**	**1,860,181**	**-1.1**
Low-Transit Cities										
Providence	15.0	2.6	78.6	12.3	37.0	.6	10.0	$380	150,639	2.5
Cleveland	15.3	4.6	79.6	10.3	30.8	1.1	30.8	$120	492,901	-11.9
Houston	15.3	3.8	76.3	14.6	25.8	.8	51.0	$570	1,702,086	2.2
Cincinnati	16.0	3.7	79.3	11.4	32.1	.8	24.0	$160	358,170	-5.5
Dallas	17.0	2.4	78.9	13.8	30.4	.7	66.0	$570	1,022,830	11.3
Hartford	17.3	1.6	78.5	13.3	28.3	1.2	100.1	$220	124,196	2.5
Detroit	19.7	2.4	82.7	10.1	21.2	.7	56.0	$380	992,038	-14.6
Mean	**16.5**	**3.0**	**79.1**	**12.3**	**29.4**	**.8**	**48.3**	**$343**	**691,837**	**-1.90**
Overall Mean		**6.8**	**74.0**	**12.2**	**40.8**	**1.3**	**42.3**	**$399**	**1,214,516**	**1.7**

[A] Values for Transit Share, Percent within 1/4 Mile Transit Access, and Annual Transit Revenue Hours Per Capita were ranked; cities were then sorted by mean rank.
[B] U.S. Department of Transportation, Federal Highway Administration, *Journey-to-Work Trends in the United States and Its Major Metropolitan Areas, 1960-1990.*
[C] Estimates are based on *Nationwide Personal Transportation Survey*, 1990 (1993). A "complex trip" is one in which the traveler makes more than one stop.
[D] U.S. Dept. of Transportation, Urban Mass Transportation Admin., *Transit Profiles: Agencies in Urbanized Areas Exceeding 200,000 Population*. 1990 Section 15 Report (1990).
[E] Schrank, D.L., et al., *Estimates of Urban Roadway Congestion - 1990*. Research Report 1131-5, Texas Transportation Institute, Texas A&M University (1993).
[F] Bureau of Census Population Data.

TABLE 4 Parking characteristics for cities grouped according to mean transit rank

Central City	Pay-to-Park Probability[A]	Parking Minimums Imposed in CBD[B]	Parking Maximums Imposed in CBD[B]	Parking Tax > 10 Percent[B]	Share of CBD Parking that's Publicly Owned[B]	Percent of Areawide Meters Located in CBD[B]	Maximum Meter Rate[B]	Stand-Alone Parking Garages Uncondition-ally Allowed in CBD[B]	Residential Permit Programs[B]
High-Transit Cities									
San Francisco	4.6	no	yes	yes	15	34	$1.50	no	yes
New York	5.5	no	yes	yes	1	26	$1.50	no	no
Chicago	4.1	yes	no	**yes	1	26	$3.00	no	yes
Boston	6.6	no	no	no	7	85	$1.00	no	yes
Seattle	5.7	yes	yes	no	3	74	$1.00	no	yes
Philadelphia	4.4	no	no	yes	9	40	$1.00	no	yes
Portland	7.7	no	yes	no	10	100	$0.90	no	yes
Mean	**5.5**	**29% yes**	**57% yes**	**57% yes**	**7**	**55**	**$1.41**	**100% no**	**86% yes**
Medium-Transit Cities									
Los Angeles	3.4	yes	no	yes	6	16	$2.00	yes	yes
Buffalo	4.5	no	no	no	52	48	$1.00	no	no
Pittsburgh	7.6	no	no	yes	41	8	$2.00	no	yes
Denver	5.8	no	no	no	10	67	$1.00	no	yes
Miami	1.4	yes	no	no	28	12	$1.00	yes	no
Milwaukee	13.7	no	no	no	12	45	$1.00	no	yes
Mean	**6.1**	**33% yes**	**0% yes**	**33% yes**	**25**	**33**	**$1.33**	**33% no**	**67% yes**
Low-Transit Cities									
Providence	4.8	no	no	no	1	97	$0.75	yes	no
Cleveland	7.2	no	no	no	7	95	$0.75	yes	yes
Houston	6.6	no	no	no	8	100	$1.00	yes	no
Cincinnati	5.2	yes	no	no	24	33	$0.50	yes	no
Dallas	6.1	yes	no	no	8	58	$1.00	yes	yes
Hartford	2.5	yes	no	no	19	24	$0.75	yes	no
Detroit	4.9	no	no	no	21	35	$1.00	yes	yes
Mean	**5.3**	**43% yes**	**0% yes**	**0% yes**	**13**	**63**	**$0.82**	**0% no**	**43% yes**
Overall Mean	**5.6**	**35% yes**	**20% yes**	**30% yes**	**14**	**51**	**$1.18**	**55% no**	**65% yes**

[A] Estimates are for metropolitan areas and are based on Nationwide Personal Transportation Survey, 1990.

[B] Telephone survey of parking officials in central cities of the 20 consolidated metropolitan areas used in the NPTS sample.

** Chicago imposes a flat $25-per-space monthly parking tax

solidated metropolitan-area sample; carpooling accounts for 12 percent of the sample commute trips; transit accounts for 7 percent; other modes—mainly walking—account for the remaining 7 percent.
- Less than one-half of the metropolitan households in the NPTS sample (41 percent) report living within ¼ mile of transit service; this suggests that for more than one-half of the respondents, transit service is not conveniently located.
- The average number of annual revenue-producing hours of transit service per capita is 1.3, which means that for each resident, an average of 1.3 hours of revenue-producing transit service is provided each year. In general, the greater the number of hours of revenue-producing service, the greater the transit frequency. This figure is important when comparing the number of transit revenue hours for one city with another.

Parking Programs Currently in Place

This section presents information about current parking programs, which the researchers obtained through a telephone survey of officials in the central cities of the 20 metropolitan areas (*23*). Tables 3 and 4 summarize selected findings from this survey and from the NPTS analysis. The paragraphs below describe parking programs that are in place in the CBD of the central cities. These programs include (1) parking regulation (especially zoning), requirements regarding stand-alone parking, and parking taxation; (2) publicly owned CBD parking facilities; (3) parking meters; and (4) neighborhood parking permit programs.

Parking Regulations

Some cities use zoning to regulate parking by mandating a minimum number of parking spaces for a given floor area for each possible use of the property. Zoning ordinances typically refer to these requirements as "parking minimums," which they usually express as the minimum number of parking spaces required per 1,000 feet of floor area. A striking finding is that minimum parking requirements for office development, which are so prevalent in suburban areas of the United States, are less common in large U.S. downtowns. Instead, market forces, rather than regulation, determine parking supply in downtowns. In several examples, a city (e.g., Portland) rations the amount of space that can be allocated for parking by using parking maximums or caps on the total amount of downtown parking. A "parking maximum" specifies the maximum number of parking spaces per unit of floor space a developer may provide, while a "parking cap" limits the total number of spaces in an area, such as the downtown core.

Another type of parking restriction limits the construction of private-sector parking lots or garages in the downtown area. Eleven of the 20 central cities limit the development of surface parking lots or stand-alone parking garages, whether in the form of locational restrictions, design restrictions, or review processes.

A third way cities regulate parking is through taxation. Cities impose taxes on parking revenues in 10 of the 20 central cities that the researchers surveyed. In six of these, the tax exceeds 10 percent of revenues; for five, the parking tax is an application of the ordinary sales tax that the county or state applies to consumer goods. The government does not levy any of these taxes on drivers in instances where landowners provide the parking free, and no city attempts to tax the portion of office lease payments that secures parking spaces for tenants. As long as the landowners bundle the office lease and the parking lease together, as they often do, the parking tax does not apply.

Publicly Owned CBD Parking Facilities

Most cities own a small amount of the downtown off-street parking supply. Most city officials, especially in large cities, consider provision of parking as a role of the private sector. The cities in the larger metropolitan areas have smaller percentages of publicly owned parking supplies than the cities in smaller metro areas. Cities with large public parking supplies often have established a parking authority that has some independence from local government to manage their supplies (e.g., Pittsburgh, Buffalo, Cincinnati, and Miami). Often these authorities also manage on-street parking and earn surpluses for the city's general fund.

Officials in five of the seven cities where a large portion (15 percent or more) of downtown parking is publicly held identified downtown commuters as the primary market served by the parking facilities. All 20 cities own at least one parking facility, usually located next to their city hall, municipal building, or convention center, which city employees or special-event attendees use. City employees often pay a highly discounted rate for parking in these facilities, which private firms typically manage on a contract basis for the city.

Parking Meters

Many cities use parking meters to control "spillover parking," that is, parking that spills on to surface streets from parking lots and garages. All 20 cities have parking meters in their CBD, although in two cases (i.e., Portland and Houston) the CBD was the only place with any metered spaces. Very few of the cities have any free parking in their downtown areas, and some are aggressively expanding the areas where parking is metered.

[23] Mildner, G.C.S., Strathman, J.G., and Bianco, M.J., "Parking Policies and Commuting Behavior." *Transportation Quarterly*, Vol. 51, No. 1 (Winter 1997) pp. 111–125.

In most cities, hourly meter rates vary by location. Only two cities—Boston and Buffalo—have a uniform hourly rate. In general, cities in large metropolitan areas have higher meter rates. In the ten largest metropolitan areas, hourly rates can be as high as $2 or $3, while in the ten smallest metropolitan areas, hourly meter rates do not exceed $1.

Neighborhood Parking Permit Programs

The problem of spillover parking in residential neighborhoods is often the result of rising CBD parking prices. Thirteen of the 20 survey cities have at least one neighborhood parking permit program to address spillover parking. Of the remaining seven, two cities (i.e., New York and Buffalo) have been interested in neighborhood permit programs but face a state constitutional prohibition, and two (i.e., Providence and Hartford) are in the smallest metropolitan areas in the survey and perhaps face only minor spillover parking problems.

Cities typically apply parking permit programs in three types of areas: residential neighborhoods on the fringe of the CBD; streets near transit stations; and neighborhoods near stadiums and arenas, hospitals, universities, and historic or tourist-destination sites. No city uses permits in the CBD itself, where pricing via meters and time limits governs supply, and officials assume that downtown residents who own a car have their own off-street space and/or do not expect free on-street parking.

Most cities with parking permit programs consider a new parking management zone only following a neighborhood request, often with explicit rules about the percentage of residents who must sign a petition. The city's traffic engineer usually conducts a parking survey. If the available on-street parking supply has a low average vacancy rate (typically daytime use) and if a high percentage of the automobiles parked in the neighborhood are licensed to owners who live outside the neighborhood, the traffic engineer usually decides whether current parking conditions are adversely affecting the neighborhood, thus warranting a permit system.

Most of the permit districts are large and allow the permit holder to park anywhere within the district; permit prices do not exceed $35 per year. City officials want to keep the districts sufficiently large so that excess resident demand for parking on certain streets can spill over into other parts of the same district.

Cities do not ration permits among neighborhood residents. In cities that have areas with insufficient parking supply for all potential car owners, officials have generally decided to avoid instituting permit zones rather than to implement them on a permit-rationing basis. Most of the permit zones allow for visitors to park in these districts, either on a short-term basis for shoppers or on an extended basis for guests. For shoppers, 1- or 2-hour time limits are typical. Permit regulations usually require guests to obtain a weekly or monthly pass, typically at some charge high enough to deter deception.

THE RELATIONSHIP OF CURRENT PARKING PROGRAMS AND TRANSIT RIDERSHIP AND SERVICE LEVELS IN U.S. CITIES

Introduction

As discussed in the previous two chapters, there is only limited research on the relationship between parking prices and transit use. There is also very little research on the relationship between transit ridership and types of parking programs, such as parking minimums, parking meters, and neighborhood permit zones. This section combines the NPTS travel and transit service data with the previous section's parking program information to attempt to identify a relationship among mode, transit service levels, and parking programs. The following paragraphs suggest that there is indeed a relationship among the number and type of parking programs, transit service levels, and transit ridership.

The researchers supplemented information from the NPTS and the parking program survey with data from the FHWA's *Journey-to-Work Trends in the United States and Its Major Metropolitan Areas, 1960–1990* (*24*). The team then classified the 20 metropolitan areas according to three transit-related variables: transit share, percentage of the respondents living within ¼ mile of transit service, and annual per capita transit revenue hours, as a proxy for transit frequency. Finally, the researchers ranked the cities based on these variables and grouped them into three main categories: high transit, medium transit, and low transit. These categories are consistent with the three categories R.W. Weant and H.S. Levinson devised in 1990 (*25*).

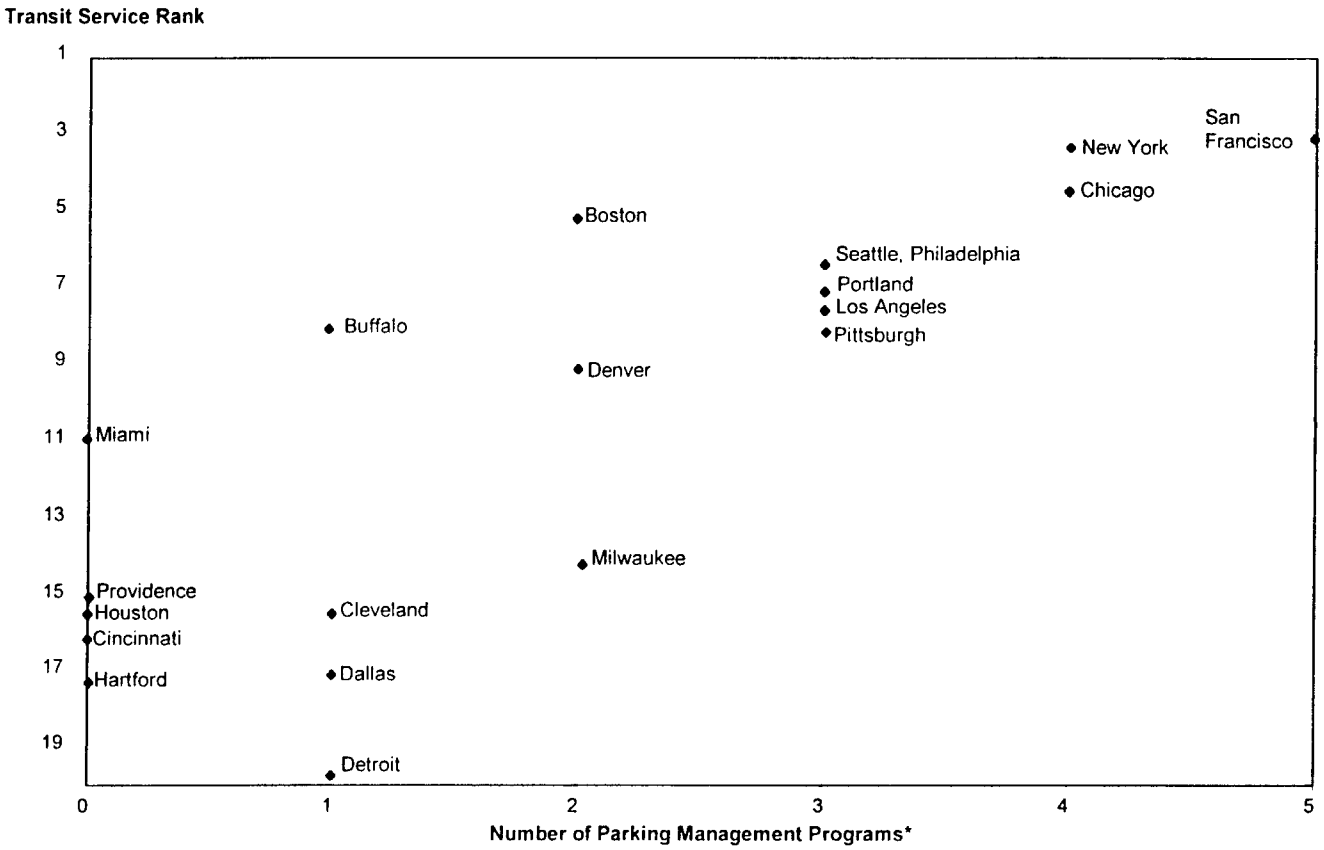
Tables 3 and 4 display the data for the categories. Although Table 3 presents metropolitan area data, Table 4 consists primarily of central city data. Figure 2 illustrates how the metropolitan areas fall into groups according to transit service ranks and how many of the following five parking programs they currently implement:

- Parking maximums are imposed in the CBD.
- A parking tax of 10 percent or more is levied.
- The maximum hourly meter rate is equal to or greater than the overall mean of $1.18.
- Stand-alone garages are not unconditionally allowed in the CBD.
- Residential permit programs are in place.

A relationship between the number and type of parking programs, transit service, and transit ridership appears to exist. For example, cities with restrictive parking policies, high parking prices and limited supply, frequent transit service, and a

[24] U.S. Department of Transportation, Federal Highway Administration, Office of Highway Information Management, *Journey-to-Work Trends in the United States and Its Major Metropolitan Areas,* 1960–1990 (1993).

[25] Weant, R. A., and Levinson, H. S., *Parking.* Eno Foundation for Transportation (1990) pp. 8–9.



*Cities were plotted by transit service rank and the number of the following parking programs in place:

- parking maximums imposed in CBD
- parking tax of more than 10 percent is levied
- maximum hourly meter rate is equal to or greater than the overall mean for all twenty cities of $1.18
- stand-alone garages are *not* unconditionally allowed in the CBD
- residential permit programs are in place

Figure 2. Cities plotted by parking policy and transit service rank.

high probability that travelers will pay to park are the most likely to have higher transit ridership rates.

Findings

This section summarizes the data displayed in Tables 3 and 4 and in Figure 2. The emphasis is on the relationship among transit service levels, transit ridership, and the type of parking programs in place in the cities, which are grouped according to transit rank.

High-Transit Cities

These cities tend to have strong, growing downtowns with (or because of) high levels of transit service and ridership, accompanied by relatively stringent parking programs. The general characteristics and important travel and parking features of the cities in this category are as follows:

- General characteristics: These central cities generally have larger populations, and most of these cities are experiencing growth. With the exception of Seattle, which has a dedicated bus tunnel, all of these cities also have established rail transit systems.
- Transit share: The average work trip transit share is, at 11.9 percent, higher for these cities than for the other cities in the sample.
- Transit service: Compared with the overall average, a larger percentage of respondents in this group are within ¼ mile of transit service, and similarly, transit per capita revenue hours are higher than the average for the sample.
- Related factors: The average annual congestion costs for travelers in these cities are higher than any other group and higher than for the sample on average. This relatively high congestion cost may explain the higher-than-average transit-ridership figures, as commuters may use transit to avoid driving in congested conditions.

- Parking programs: Only two of the seven central cities in this category impose parking minimums, a smaller ratio than in the other two categories. Over half, however, impose parking maximums, whereas none of the cities in the other two categories do.
  - Four of the seven cities impose a parking tax of 10 percent or more.
  - None of the cities in this category allows parking structures to be built in the CBD unconditionally.
  - Commuters in these cities are about as likely to pay to park as is the case with the sample overall.
  - The maximum hourly meter rate is, at $1.41, relatively high when compared with the overall average of $1.18.
  - A lower share of the CBD off-street parking is publicly owned than average—7 percent compared with the overall average of 14 percent.
  - Residential permit programs are in place in all but one of the seven cities in this category.

Medium-Transit Cities

These cities have moderate levels of transit service and transit ridership. There is a wide variation in the number and type of parking programs in place. In general, these cities tend to have downtowns that are not as strong economically as high-transit cities, and they are less likely to have restrictive parking policies.

- General characteristics: The parking and transit policies of these cities are mixed in nature in that, from the perspective of historic and economic development, these cities appear to be moving away from the less restrictive parking approach of low-transit cities to the more regulatory approach of the high-transit cities.
- Transit share: At 5.2 percent, transit share is lower than the overall average of 6.8 percent, but higher than for the low-transit cities.
- Transit service: The percentage of travelers in this category who live within ¼ mile of transit is smaller than in the high-transit category, but larger than in the low-transit category. Likewise, at 1.3, annual transit revenue hours per capita is less than for the high-transit cities, but greater than for the low-transit cities.
- Related factors: Of the three metropolitan types, the percentage of commutes that are complex is lowest for this group. That is, a smaller percentage of people make more than one stop during their commute trip. This factor may contribute to the fact that a greater percentage of people in this category take transit to work than in the low-transit cities, given that transit is more convenient for those who do not have complex trips than for those who do.
- Parking programs: These cities are generally unlikely to impose parking minimums or maximums, thus indicating little public restriction of parking in terms of zoning requirements.
  - Only two of the cities in this group—Los Angeles and Pittsburgh—impose a parking tax of 10 percent or more.
  - One-third of these cities allow parking structures to be built in the CBD without conditions.
  - Travelers in these regions are more likely than average to pay for parking (6.1 percent compared with 5.6 percent overall).
  - A smaller percentage of cities in this category have residential permit programs than the high-transit cities.

Low-Transit Cities

These cities tend to be growing slowly or losing population, with low levels of transit service and ridership, accompanied by relatively lenient parking programs.

- General characteristics: Three of these cities—Cincinnati, Detroit, and Cleveland—have experienced population decline, while the remaining four have remained fairly stable or have experienced growth, mainly because of annexation.
- Transit share: Transit share is low in these cities; at an average of 3.0 percent, it is lower than that of the other two categories.
- Transit service: There are also low levels of transit service in the cities in this category: only 29.4 percent of the respondents live within ¼ mile of transit access, and there are only .8 per capita revenue hours, compared with the overall average of 1.3.
- Parking programs: Three of the seven cities in this group impose parking minimums; none imposes maximums.
  - Three of the seven cities have residential permit programs.
  - None of the cities has a parking tax greater than 10 percent (Houston is the only low-transit city with a parking tax, and it is only 8 percent).
  - All of these cities allow the construction of parking structures in the CBD without any condition or review process.
  - Travelers in these cities are the least likely to pay to park, and the maximum hourly rate for meters is very low—$0.82 compared with the overall average of $1.18.

THE NATURE OF TRAVEL AND PARKING ACTIVITY IN EDGE CITIES AND OTHER NONCENTRAL LOCATIONS

Introduction

There is very little systematic information on the relationship between parking and travel activity in areas outside of

the central city or even outside of the CBD. This section supplements the information in the previous sections with similar data from areas of new development outside of both the CBD and the central city as a whole.

The researchers surveyed parking and travel behavior in two types of noncentral locations: 11 edge cities and Midtown Atlanta, located outside of Atlanta's CBD. This section presents the general findings of these case studies; Chapter 6 provides more detail to illustrate specific implementation issues.

Edge Cities

Parking management, including parking pricing, is relatively common in the CBDs of large urban areas. Most of the growth in jobs and population in recent decades has occurred in the suburbs, however. Many suburbs have now matured to the point where they have activity centers of their own that in several cases compete with the central city's CBD. These new centers are referred to as "edge cities," after the book by Joel Garreau (*26*). Policy-makers in edge cities occasionally employ parking management techniques to avoid providing more parking spaces and in order to promote alternatives to driving alone in suburban commuting markets.

Although there are exceptions, the typical edge city exhibits limited parking management strategies, limited alternative mode choices, and limited information on parking, mode of travel, employment densities, and other similar data. Edge cities rarely exist as stand-alone entities, whether as incorporated cities, special use districts, or private developments held by a single corporation. Instead, edge cities are often located in multiple jurisdictions, with multiple landowners, developers, and employers. A typical edge city might be roughly equivalent to the market area of a single transportation management association (TMA)—if one exists—encompassing 20,000 to 30,000 employees.

Of the 20 metropolitan areas identified in the previous sections of this chapter, 11 have at least one TMA serving an edge city or other suburban location. The existence of TMAs is an *a priori* indication of interest in TDM, although many of these do not actively promote parking management, because of unfavorable conditions (primarily, excess supply). Those that do promote parking management strategies are more likely to support preferential parking for carpools and vanpools than pricing policies per se.

Typical edge cities are characterized by ample, free parking. The office developments in these areas are occupied by firms with an average of two to three employees per 1,000 square feet of leasable office space. Typical suburban zoning ordinances require four to five parking spaces per 1,000 square feet of leasable space. The result is an oversupply of parking. Rarely is more than 10 percent of available parking priced; such parking is typically for executives or is valet parking, covered parking, or parking closer to the building entrances.

Suburban areas typically exhibit a greater reliance on driving alone than do central city or rural areas. Edge cities may account for much of the transit use in suburban areas, typically because of their high employment density and greater number of transit-friendly rather than traditional suburban design features.

Midtown Atlanta

This section focuses on the Special Public Interest District (SPID) in Midtown Atlanta (*27*). Originally designed as one of Atlanta's first suburbs, Midtown declined in both population and employment numbers during the 1960s and 1970s. Since then, the City of Atlanta has used SPIDs to promote new development in areas around Midtown rail transit stations, which the Metropolitan Atlanta Rapid Transit Authority (MARTA) operates. Ordinances do not require buildings locating inside SPIDs to have any parking facilities. Buildings outside SPIDs must have at least two parking stalls for every 1,000 square feet of gross leasable area. In addition, developers can build more intensively inside than outside the SPIDs.

In terms of attracting new development to SPID areas, Atlanta's SPID policy appears to be effective. Since 1980, new commercial construction within SPIDs has exceeded the construction outside SPIDs by about 1 million square feet. As for parking ratios, despite the absence of parking minimums inside SPIDs, there is at first glance no appreciable difference in the resulting parking ratios (ratios of parking spaces to leasable square feet) inside and outside SPIDs. However, when the researchers took into consideration *all* parking facilities, including surface lots not associated with buildings, the parking ratio inside the SPIDs is decidedly lower than outside. This fact may simply reflect the larger supply of land outside SPIDs than inside. At any rate, because parking is more constrained inside the SPIDs, the lower ratios do suggest that the SPID parking policy does reduce parking supply by virtue of more intense development in SPIDs as a result of less land devoted to parking as an intensive use.

As for transit ridership, 10.8 percent of the workers employed inside SPIDs use rail transit in their journey to work, compared with about 6.3 percent who are employed outside SPID boundaries. From 1988 to 1990, annual rail trips into Midtown fell steadily both inside and outside SPID areas. The decline has since stabilized, and this stabilization has been occurring at a somewhat faster rate inside the SPIDs than outside. This information suggests that transit ridership levels benefit from more intense development near transit stations in areas where parking is constrained or at least where parking minimums are not imposed.

[26] Garreau, J., Edge City: *Life on the New Frontier.* Doubleday (1992).

[27] Nelson, A.C., Meyer, M.D., and Ross, C.B., "Parking Supply Policy and Transit Use: Case Study of Atlanta, Georgia." Paper presented at the Transportation Research Board 76th Annual Meeting, January 12–16, 1997, Washington, D.C., Preprint No. 97-0135.

CHAPTER SUMMARY AND CONCLUSIONS

The researchers' analysis of the NPTS sample revealed that most respondents—74 percent—continue to drive alone in their journey to work; about 7 percent commute by public transportation. Part of the explanation for the continuing low level of transit ridership is that transit service, as represented by the percentage of respondents who live within ¼ mile of transit access, does not yet compete in terms of accessibility and proximity with the private automobile. Less than one-half of all respondents—even in the densest, most heavily populated metropolitan areas with rail service—live within ¼ mile of a transit stop.

Another explanation for the low level of transit ridership is that, overall, parking policies continue to accommodate the automobile. This has been the case historically, but continues even in the present era, when policy-makers are turning increasingly toward the use of parking strategies as part of a larger transportation policy package aimed at restoring balance in the transportation system. Only 20 percent of the 20 central cities surveyed place maximums on the amount of parking that may accompany new development; only 30 percent of the cities tax parking at a rate greater than 10 percent (30 percent of the cities do not tax parking *at all*). Most of the cities (55 percent) allow stand-alone parking garages to be constructed in the CBD without any type of restrictions or conditions. The average maximum hourly meter rate is, at $1.18, not much more than the average transit fare (*28*).

In general, the researchers did find patterns among the 20 metropolitan areas. Central cities that tend to have restrictions on parking and/or higher parking prices also tend to have higher levels of transit service and transit ridership. Cities with fewer restrictions and lower parking prices tend to have lower levels of transit service and ridership. The analysis reveals, however, considerable variation among the central cities examined, as well as among the edge cities and other noncentral areas. Thus, transit ridership effects may vary depending on a city's size, population, and age. Another important factor in determining how parking pricing and transit service levels interact to affect transit ridership is whether public officials strategically implement parking programs as part of a larger transportation policy or whether they allow market forces to guide parking supply.

Los Angeles, for instance, is a growing city with a population more than tenfold that of Buffalo, a city experiencing marked population decline. Los Angeles's transit service levels are lower than Buffalo's, and its total annual per capita congestion costs are nearly double. Los Angeles is an example of a city that is moving toward the paradigm of implementing restrictive parking strategies as part of an overall transportation policy aimed at improving modal balance. Buffalo is an example of a city with fewer restrictions, still apparently tending toward the auto-accommodating paradigm of parking policy. Yet, despite these differences between the two cities, their transit share is virtually identical: 4.6 percent for Los Angeles and 4.7 percent for Buffalo.

In another vein, Portland is an example of a city that has a long tradition of implementing restrictive parking programs as part of a larger transportation policy aimed at achieving higher transit ridership. There is a relatively high probability that Portlanders will pay to park, yet maximum hourly meter rates are, at $0.90, relatively low. Transit share in Portland, while moderately high at 5.4 percent, is much lower than in a city such as New York, where, market forces rather than policy decisions have resulted in much higher parking prices. When parking policies are combined with high transit service levels, the result is very high transit ridership levels.

Despite individual variations, this research found that there is, again, an overall tendency for higher transit ridership levels to be associated with higher parking prices and more restrictive parking programs. This research also found, however, that cities may vary considerably in terms of size, age, geography, policy approaches, historical development patterns, and other individual characteristics. This variation makes it difficult, if not impossible, to provide a specific formula for policy-makers implementing parking programs. In particular, it is difficult to provide an algorithm for pricing levels that might result in specific transit ridership levels. For this reason, the research team recommends combinations of parking strategies and other TDM techniques to improve the balance in a city's transportation system. Chapter 7 discusses these recommendations in greater detail.

[28] Hartgen, D.T., Segedy, J.A., and Tilley, M.S., "Comparative Performance of Major U.S. Bus Transit Systems: 1988–1994." Center for Interdisciplinary Transportation Studies, University of North Carolina at Charlotte (May 1996).

CHAPTER 4

THE EFFECTS OF PARKING STRATEGIES ON TRAVEL CHOICES

The value of employer-paid parking is so substantial that it virtually invites commuters to drive to work alone.

—Donald C. Shoup (*29*)

INTRODUCTION

The purpose of this chapter is to examine the relationship between parking strategies and mode choice and, in particular, to assess the effectiveness of these strategies in increasing public transportation ridership. The focus is on work trips, because they are more sensitive than off-peak trips to most of the parking strategies this study analyzes. The sections, summarized below, present the findings.

- *How Does Parking Price and Transit Service Affect Transit Use in U.S. Cities?* This section presents the research team's findings on the relationship between parking pricing and mode choice, while controlling for socioeconomic factors. This study of households in 20 metropolitan areas allowed the researchers to account for differences among cities. The researchers estimated mode shares by varying levels of priced parking and transit service.
- *How Does Parking Price and Transit Service Affect Transit Use for Downtown-Destined Work Trips?* This section presents findings regarding mode shares for alternate levels of posted parking price and transit service, measured by the number of bus lines serving a household. Like the previous section, the goal of this section is to show how transit service and parking pricing affect mode choice; this analysis focuses on the downtown-destined work trip and uses data from a single metropolitan area (Portland, Oregon).
- *How Does Increasing Parking Price Compare with Other Strategies in Reducing Work Trip SOV Use?* This section presents findings regarding the relative effect of several regionwide transportation strategies on SOV work trip travel. The aim of this material is to compare parking pricing with other transportation strategies that policy-makers at the regional level might employ, such as an increase in the gasoline tax.
- *How Do Different Parking Strategies Compare with One Another in Reducing Work Trip SOV Use?* This section focuses on various parking strategies that policy-makers might employ within a metropolitan region. The purpose of this section is to compare the effects of the individual parking strategies.

[29] Shoup, D.C., "Cashing-Out Free Parking." *Transportation Quarterly*, Vol. 36 (1982) p. 352.

HOW DOES PARKING PRICE AND TRANSIT SERVICE AFFECT TRANSIT USE IN U.S. CITIES?

Introduction

This section estimates commute mode shares (e.g., SOV, carpool, and transit) as a function of transit access and service, parking price, household socioeconomic variables, and residential location. This information is important in revealing the role that parking price and transit service play in affecting a traveler's decision to drive alone, carpool, or use public transit.

This analysis concluded that, in general, transit share is influenced more by the probability that people pay to park than by either transit frequency or transit accessibility (i.e., proximity of households to transit stops). In addition, transit frequency has more effect than transit accessibility. Finally, pay-to-park probability and transit frequency combined have the greatest effect on transit share. These results are discussed in greater detail in the Findings section, below.

Methodological Considerations

Methodology

The research team conducted two analyses to study the effect of transit service and parking prices on commuting. Each used a different source of parking data—one source was cross-sectional data from 20 metropolitan areas and the other from a single metropolitan area (i.e., Portland, Oregon). The cross-sectional parking data and model are discussed in this section, and the Portland data and model are discussed later.

The cross-sectional data cover commuters from 20 consolidated metropolitan areas which were chosen by the census bureau. The commuters were interviewed for the 1990 NPTS. The NPTS provides the only publicly available, reliable

source of data on parking and travel at the metropolitan level. The research team supplemented the NPTS data with information regarding level of transit service and congestion. The team used these data to examine how changes in transit service and the probability that people will pay to park will affect mode choice.

Limitations of the Analysis

One limitation of this analysis is that the researchers had to estimate the *probability* that people *would pay to park*, rather than use the actual amount of parking prices. This is because data on the actual price of parking exist only for auto users, not for nonauto users. Another important limitation of this analysis is that the model simulates modal responses to varying levels of probability of paying to park, transit frequency, and transit access, at the metropolitan level; it does not, however, support estimating modal shares for specific individual metropolitan areas.

Findings

The Effect of Transit Service and Parking Pricing on Mode Choice

Table 5 and Figures 3 through 5 present the predicted mode shares for alternate levels of three variables: transit access, transit revenue hours per capita, and pay-to-park probability. The "transit access" variable is a measure of transit service and represents the percentage of NPTS respondents who live within ¼ mile of a transit stop. The "transit revenue hours per capita" variable is also an indicator of transit service, representing a metropolitanwide measure of transit frequency. Finally, the "pay-to-park probability" variable is a measure of parking pricing, representing the likelihood that commuters would pay for parking at work if they were to drive.

As the simulation results presented in the table and figures indicate, the two transit-service variables affect mode share, but the pay-to-park probability has a relatively larger effect. When the likelihood of paying to park doubles from .05 to .10, the percentage of people choosing SOV drops from 77.1 to 67.4, and the percentage of those choosing transit increases from 9.8 to 20.5.

The effect that changes in transit service have on mode share is less than the effect of the pay-to-park probability. As the percentage of residents within ¼ mile of transit doubles from 30 percent to 60 percent, the percentage choosing SOV drops from 78.5 to 77.5, while the percentage choosing transit increases from 8.6 to 9.3. Similarly, when the number of revenue hours per capita doubles from .75 to 1.50, the percentage of travelers choosing SOV drops from 80.6 to 78.2, and the percentage choosing transit increases from 5.3 to 8.6. These figures indicate that changes in transit frequency have larger effects than changes in transit access. However, as indicated above, changes in the probability that one will pay to park have a greater effect than changes in either transit frequency or transit access.

TABLE 5 Predicted mode shares for alternative levels of transit access, transit service, and pay-to-park probability

	Predicted Mode Shares		
Attribute Level	**SOV**	**Carpool**	**Transit**
1/4 mi Transit Access (%)			
30	.785	.129	.086
40	.781	.130	.089
50	.778	.131	.091
60	.775	.132	.093
Annual Revenue Hrs Per Capita			
0.75	.806	.141	.053
1.00	.800	.138	.062
1.25	.792	.135	.073
1.50	.782	.132	.086
1.75	.772	.128	.100
2.00	.760	.125	.115
Pay-to-Park Probability			
.01	.816	.138	.046
.05	.771	.131	.098
.10	.674	.121	.205
.15	.544	.119	.337

Increasing both transit frequency and parking price has the greatest effect on transit share, as shown in Figure 6. For example, transit share increases nearly 300 percent, from 6.5 to 24.5 percent, when transit frequency doubles from 1.0 transit revenue hours per capita to 2.0 hours per capita *and* when pay-to-park probability doubles from .05 to .10.

While the changes in the predicted shares for transit and SOV are consistent with the outcomes of other studies, the slight decline in carpooling associated with increasing the likelihood of charging for parking is not. Willson (*30*), for example, estimated that an increase in downtown Los Angeles parking costs from $3 to $6 per day would result in a 3-percentage-point increase in carpooling's share, while the data here suggest a decrease.

[30] Willson, R. W., "Suburban Parking Requirements: A Tacit Policy for Automobile Use and Sprawl." *Journal of the American Planning Association*, Vol. 61 (1985) pp. 29–42.

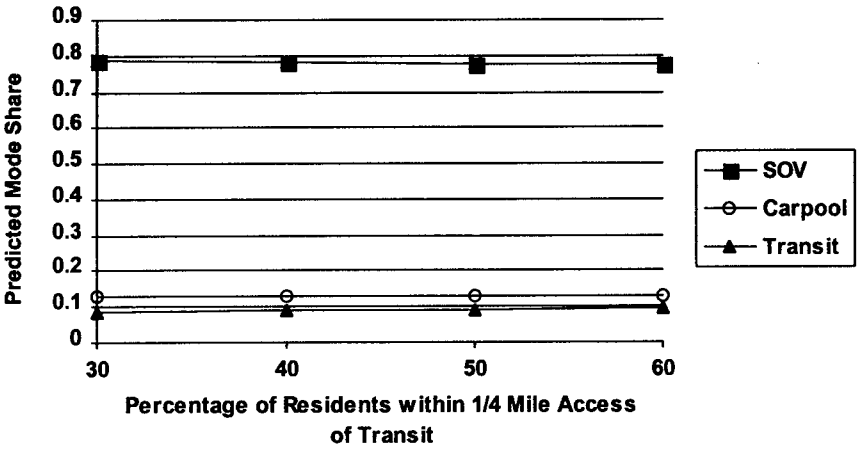


Figure 3. Effects of transit access on mode share.

The Effects of Other Factors on Mode Choice

The research team also looked at how the residential location of travelers, as well as socioeconomic factors such as household income and structure, affect mode choice (*31*). A summary of these findings follows:

- Central city residents are progressively more likely than suburbanites and exurbanites to choose transit over carpooling or driving alone.
- Within each residential location (i.e., central city, suburbs, and exurbs), the farther one lives from one's work, the more likely one is to choose transit over SOV and carpooling; this finding is likely related to the fact that many of the large metropolitan areas in the sample have commuter rail.
- Decreases in household income are associated with a greater likelihood of choosing transit over both driving alone and carpooling.
- Younger commuters are more likely to choose transit than are older commuters.
- Even when controlling for household type, suburban residents are more likely than central city residents to choose carpooling over driving alone, and central city residents are more likely to choose transit over both carpooling and driving alone.
- Multiple-adult, single-adult-with-children, and multiple-adult-with-children households are progressively more likely to choose carpooling over driving alone than are single-worker households.
- Households at all income levels composed of multiple adults with children and single adults with children are progressively more likely to choose transit over carpooling.

[31] See also Strathman, J., and Dueker, K. "Transit Service, Parking Charges, and Mode Choice for the Journey to Work: An Analysis of the 1990 NPTS." *Public Transportation*, Vol. 1 (1996) pp. 13–38.

HOW DOES PARKING PRICE AND TRANSIT SERVICE AFFECT TRANSIT USE FOR DOWNTOWN-DESTINED WORK TRIPS?

Introduction

Although the researchers suspected that most of the commuters who pay to park work in downtowns, the NPTS data did not identify destination. To provide more specific information, the researchers used data from a single metropolitan area (i.e., Portland, Oregon), where work destinations were geocoded. The team investigated in more detail the relationship among mode choice, parking price, and transit service, stratifying the analysis by residential location of workers, as urban (i.e., central city) or suburban.

The Findings section below presents the conclusions from this analysis. Table 6 and Figures 7 through 10 also illustrate these conclusions—that parking pricing and transit service levels together strongly influence transit share for the downtown-destined work trip.

Methodological Considerations

To conduct this analysis, the research team selected work trips destined to the greater downtown area, from a 1985 Portland household and travel-activity survey, which asked respondents specific questions about parking. The team then applied data on parking costs and conditions (i.e., price paid, price faced, and posted price) to the respondents' geocoded workplace destinations. The researchers also included data on the number of bus lines serving the respondents' geocoded place of residence.

This analysis, like the national cross-sectional analysis, cannot provide estimates of commuters by mode at specific locations, nor are the mode shares directly transferable to other cities. The research team also found the parking prices that nonauto users report were unreliable or missing. Therefore, the team independently recovered posted parking price

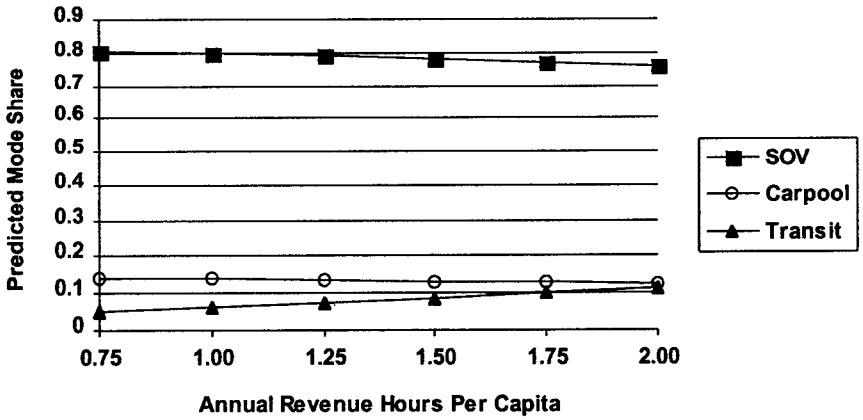


Figure 4. Effects of annual revenue hours per capita on mode share.

data at the city block level and associated these with the destination of work trips. The advantage of posted parking price is that it is the price that everyone parking at that location faces. In reality, some take transit, some park free in employer-provided parking, and some choose to park at some distance from the workplace and walk to avoid parking charges; however, these choices are responses to the posted parking price that all commuters face.

Findings

The Effect of Increasing Parking Prices on Mode Share for Urban and Suburban Residents

Simulation results, which Table 6 and Figure 7 present, indicate that as parking prices increase, the transit share increases, but the effect diminishes with higher parking prices. For example, for urban residents, when the monthly parking price increases from $20 to $30, the transit share increases by 8 percent. However, when parking price increases from $90 to $100, transit share increases by only 6 percent. This suggests that for urban residents, marginal increases in parking prices at the high end do not have as much effect on transit share as do parking price increases at the low end. On the other hand, for suburban residents who work downtown and choose transit, increases in price at the high end have more effect on transit share. This indicates that for price increases at the high end (say, from $90 to $100), urban residents are less sensitive to parking prices than their suburban counterparts. This may be because parking prices at the high end are more likely to affect only those urban residents who have more disposable income.

Table 6 and Figure 8 also show how parking price affects SOV use for urban residents who work downtown. As the monthly parking price increases from $20 to $30, SOV share decreases by 2 percent. This percentage change increases to 5 percent at higher levels, i.e., when parking price increases from $90 to $100. This suggests that for urban residents who work downtown, the effect on SOV share is greater when parking prices at the high end increase. For suburban

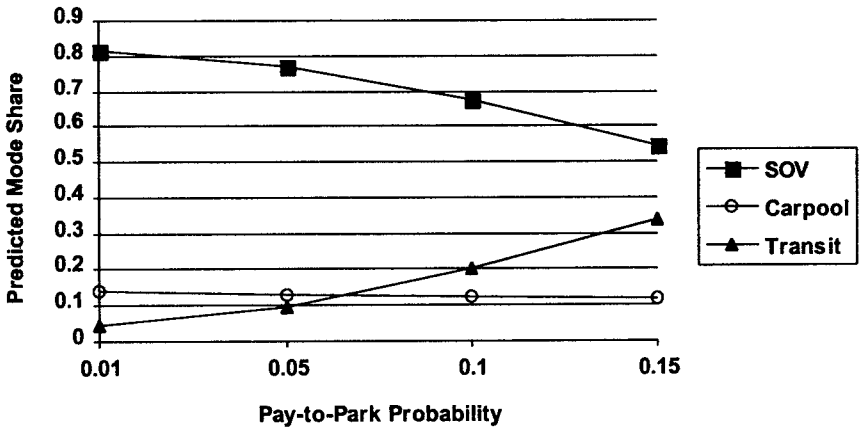


Figure 5. Effects of pay-to-park probability on mode share.

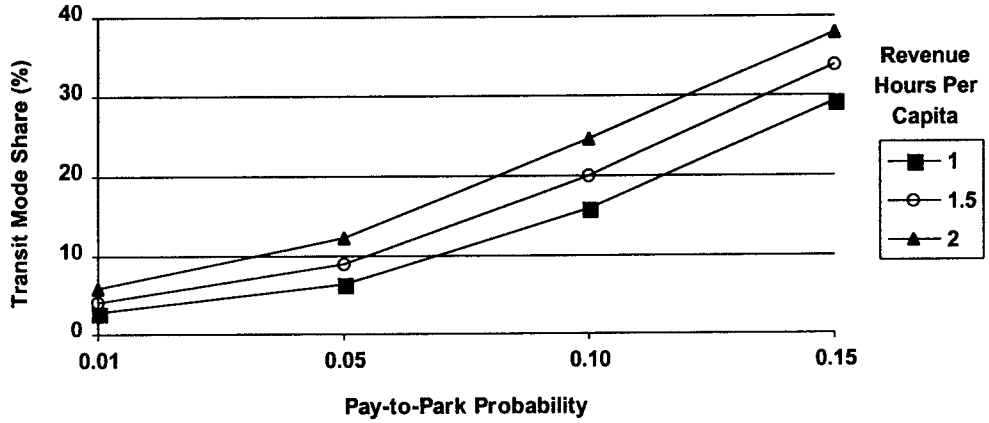


Figure 6. Effects of pay-to-park probability and revenue hours per capita on transit mode share.

residents who work downtown and use SOVs, the effect of parking price is less marked at all levels, perhaps reflecting the smaller array of transportation alternatives available to suburban residents.

The Effect of Increasing Transit Service on Mode Share for Urban (Central City) and Suburban Residents

Table 6 and Figures 9 and 10 show the effect of transit service as measured by the number of transit lines serving residents, holding parking price constant. For urban residents who work downtown, the transit share increases as the number of bus lines serving their home location increases. The rate of change also increases; that is, transit share for urban residents increases by 9 percent when the number of bus lines serving their home location increases from one to two, and it increases by 18 percent when the number of lines increases from six to seven. For suburban residents who work downtown, however, transit share increases by 25 percent when the number of lines serving their residence increases from one to two, but by only 17 percent when the number of lines increases from six to seven.

The table and figures also show the effect of changing the number of bus lines on SOV share. For both urban and suburban residents, the SOV share decreases as the number of bus lines increases. For urban residents, increasing the number of bus lines at the low end, say from one to three, has a small effect on SOV use compared with increasing the number of bus lines from five to six or from six to seven. For suburban residents, the effect is more uniform from the low to the high end; that is, increasing the number of bus lines from one to three has an effect on SOV use similar to that of increasing the number from five to seven.

Figures 11 through 14 reveal that the combination of low parking prices and high transit service is more effective in increasing transit share and decreasing SOV share than the combination of high parking price and low transit service. Not surprisingly, the *most* effective means of increasing transit share is by increasing parking price *and* improving transit service.

The findings from the Portland analysis are generally comparable to those of Gillen (*32*), who studied commuters' mode choices in metropolitan Toronto, and Willson (*33*), who analyzed commuting to downtown Los Angeles. Gillen found the price elasticity of demand for parking to be relatively inelastic, at –0.31. This means that if the price of parking were increased by 10 percent, the quantity of parking demanded would be reduced by only 3.1 percent. The findings for Portland show that the decision to drive alone is somewhat more sensitive to parking prices. The researchers found that, based on a monthly parking price of $80, the price elasticity of demand for parking in urban Portland is –0.58 with respect to SOV use and –0.43 with respect to carpooling. This means, for example, that if the monthly price of parking were increased 10 percent—from $80 to $88—the quantity of parking demanded by SOV users in urban Portland would decrease by 5.8 percent. Similarly, the researchers found price elasticities of demand for parking in suburban Portland to be –0.46 with respect to SOV use and –0.44 with respect to carpooling (*34*). The higher elasticities resulting from the Portland study likely reflect the use of destination-specific parking data. This type of data tends to involve less measurement error and thus avoids underestimating elasticity coefficients.

[32] Gillen, D.W., "Estimation and Specification of the Effects of Parking Costs on Urban Transport Mode Choice." *Journal of Urban Economics,* Vol. 4 (1977) pp. 186–199.

[33] Willson, R.W., "Estimating the Travel and Parking Demand Effects of Employer-Paid Parking." *Regional Science and Urban Economics,* Vol. 22 (1992) pp. 133–145.

[34] See also Peng, Z., Dueker, K.J., and Strathman J., "Residential Location, Employment Location, and Commuter Responses to Parking Charges." *Transportation Research Record 1556* (1996), p. 114.

TABLE 6 Estimated mode shares for alternative levels of transit service and parking price, Portland, Oregon

Area of Residence	Urban		Suburban	
	Transit Share	SOV Share	Transit Share	SOV Share
Number of Bus Lines Serving Resident				
1	.108	.855	.079	.897
2	.118	.839	.099	.877
3	.124	.826	.119	.859
4	.149	.789	.141	.836
5	.177	.754	.167	.811
6	.211	.715	.197	.782
7	.249	.672	.231	.749
Monthly Downtown Parking Price				
$ 20	.122	.806	.066	.908
30	.133	.786	.077	.895
40	.144	.764	.089	.880
50	.156	.740	.103	.864
60	.167	.715	.118	.846
70	.179	.688	.135	.826
80	.191	.661	.154	.803
90	.203	.631	.176	.779
100	.215	.602	.199	.752

HOW DOES INCREASING PARKING PRICE COMPARE WITH OTHER STRATEGIES IN REDUCING WORK TRIP SOV USE?

Introduction

In assessing how policy-makers might use parking strategies to increase transit ridership, the researchers conducted two simulations. The first analysis, which this section presents, uses data from five West Coast metropolitan areas to assess various regionwide transportation strategies and compares their effects and effectiveness in terms of several indicators, including VMT and work trip SOV. The second simulation, which modified conventional travel-demand models for a single city—Portland—is discussed later.

Table 7 summarizes the results of the West Coast metropolitan-area analysis, which the Findings section, below, presents in more detail. In general, the analysis indicates that increasing parking prices for employees is more effective in reducing SOV travel than any of the other pricing strategies examined. In addition, parking pricing affects the SOV travel of residents of the central city more than residents of other parts of a metropolitan area and it is most effective when applied in larger central cities. Transit service is also more important in affecting SOV travel in larger than in smaller cities.

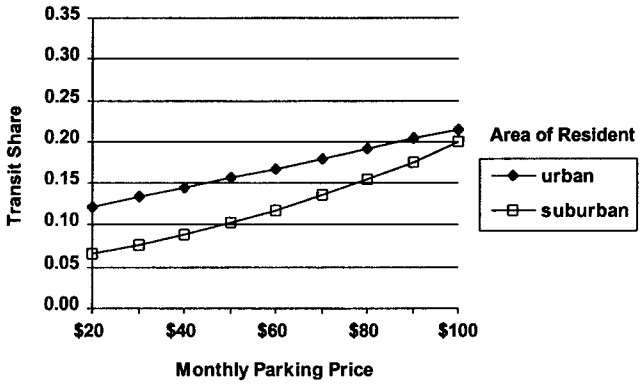


Figure 7. Effect of monthly downtown parking price on transit share.

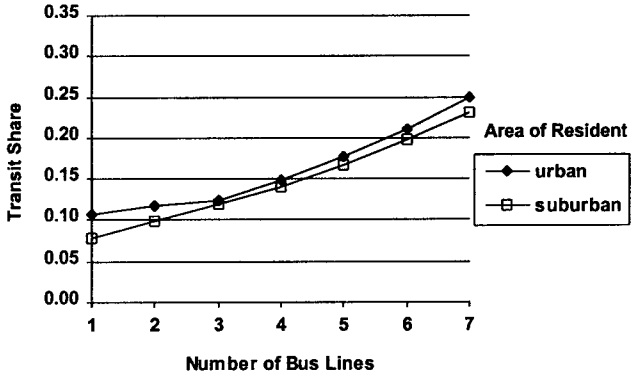


Figure 9. Effect of number of bus lines serving resident on transit share.

Methodological Considerations

The first simulation used a planning model, the Short-Range Transportation Evaluation Program (STEP), to estimate mode shares as a result of the implementation of different travel and parking strategies. Five West Coast metropolitan areas were analyzed—Los Angeles, Sacramento, San Diego, San Francisco, and Seattle—to estimate how various types of transportation pricing programs would affect factors such as VMT, SOV, and regionwide trips.

The STEP modeling process consists of an integrated set of travel demand and travel activity models, using household, rather than zonal averages, as the basic units of analysis. The research team chose for analysis five strategies that would be most effective if implemented across a region, rather than in one specific local jurisdiction. Increasing employee parking prices by $3 per day, congestion pricing, emissions fees, gasoline tax increases, and mileage-based fees are the five strategies the team considered. Further, the researchers modeled two general scenarios of employee parking prices: (1) a flat $5 regionwide parking charge and (2) a charge that varies by location, at $5 in the CBD, $2 in the central city, and $0 in the suburbs.

The researchers consulted local policy-makers in defining the pricing amounts used in the analysis. The amounts they chose were based on the specific goal of each strategy. Because the researchers and policy-makers expected each strategy to fulfill a different function, or achieve a different goal, they chose different pricing levels for the different strategies. That is, they chose a $0.06-per-mile mileage fee because of its expected effect on congestion, while they chose a $0.01-per-mile emissions fee because of its expected effect on emissions. The different goals, or functions, of the strategies preclude comparison of equivalent pricing levels for the five strategies.

The strength of the STEP modeling approach is its ability to manipulate relevant travel-cost variables that influence mode choice in an integrated modeling framework that includes household location choice, workplace choice, auto ownership, trip generation, destination choice, and time of day of travel for both work and nonwork trips. However, the model trades precision at the network level for a more detailed and accurate measure of the effects of type of location and mode choice. Consequently, while the STEP model is good for comparing parking pricing to other transportation strategies, such as congestion pricing and emissions

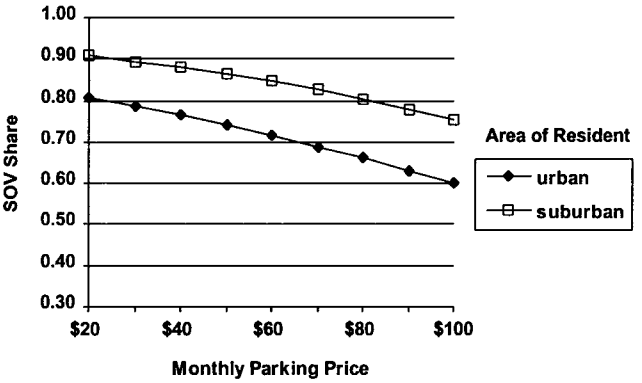


Figure 8. Effect of monthly downtown parking price on SOV share.

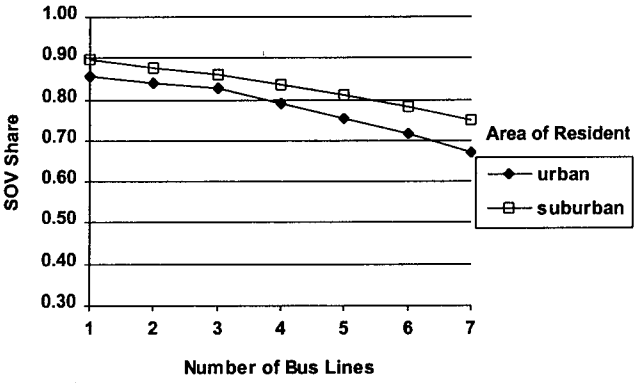


Figure 10. Effect of number of bus lines serving resident on SOV share.

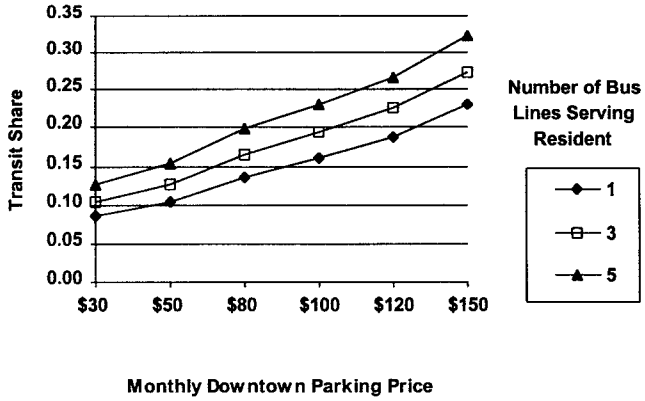


Figure 11. Transit share, by number of bus lines serving urban resident and monthly downtown parking price.

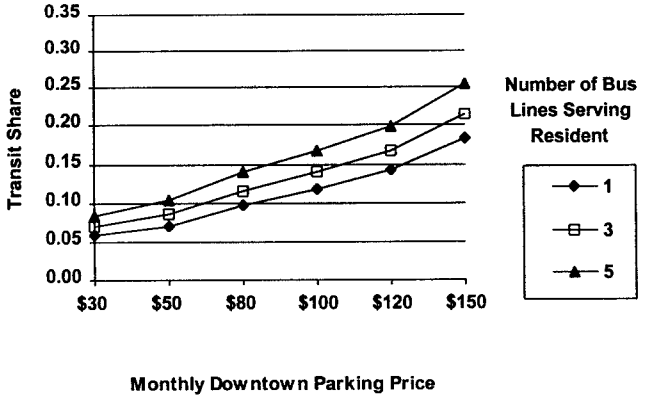


Figure 13. Transit share, by number of bus lines serving suburban resident and monthly downtown parking price.

fees, it can apply prices only to broad categories of trips and locations.

The analysis that the Findings section, below, presents is able only to provide guidance as to the *likely* effects of parking pricing on SOV use for different types of location (i.e., central city, suburbs, CBD), city size, and levels of transit service. However, this guidance should be interpreted as very general in nature, as the model applies the prices by trip type (e.g., home-based work trips) when in reality it would be extremely difficult, if not impossible, actually to levy these prices by trip type.

Findings

This section presents the findings of the West Coast analysis by strategy.

Employee Parking Charge

The primary parking pricing strategy the researchers examined is a flat, regionwide increase of $3 per space per day for all employee parking spaces. The researchers also varied the pricing by regional density and transit service, which the next section discusses.

On an average daily basis, the $3 parking charge is higher in monetary terms than the gas tax increase or the congestion-, emissions-, or mileage-based fees. It also specifically targets the work trip. The only other charge specifically targeting the work trip is congestion pricing, but at $0.06 per mile, the congestion fee averages only $1.20 per day, since average work trips are 10 miles each way in length. This explains why, as Table 7 shows, the parking fee is the most effective strategy for reducing SOV work trips. The average reduction the researchers found was 9.3 percent, ranging from an 11.7-percent reduction in Seattle to an 8.1-percent reduction in San Diego. This range suggests that parking pricing may be most effective in cities such as Seattle or San Francisco, which have strong downtown-destined commutes.

Parking Pricing: Accounting for Variations in Regional Density and Transit Service

The strategy of pricing employee parking emerges from the analysis as a potent influence on SOV commuting. A parking

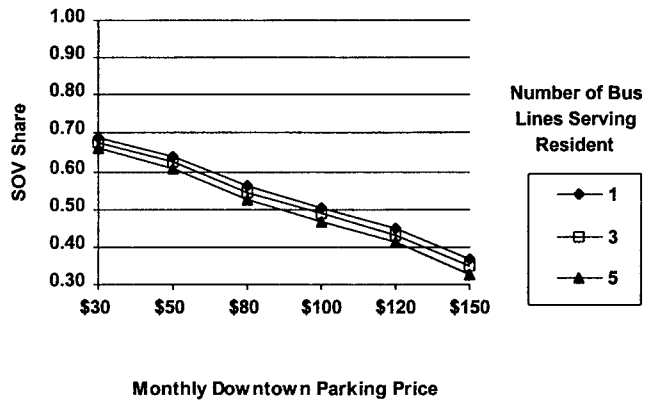


Figure 12. SOV share, by number of bus lines serving urban resident and monthly downtown parking price.

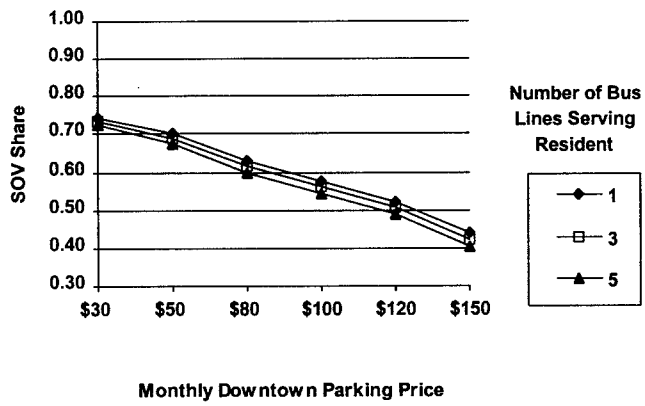


Figure 14. SOV share, by number of bus lines serving suburban resident and monthly downtown parking price.

TABLE 7 Variations in response to travel-pricing measures in five western cities

Strategy	Los Angeles	Sacramento	San Diego	San Francisco	Seattle	Mean	Std. Dev.
Percentage Change in Regionwide SOV Work Trips							
Employee Parking Charge of $3	-8.8	-8.4	-8.1	-9.6	-11.7	-9.3	1.5
Congestion Pricing	-9.6	-1.6	-2.4	-11.9	-5.8	-6.3	4.5
Emissions Fee	-0.3	-0.1	-0.2	-0.1	---	-0.1	0.1
Gasoline Tax Increase of $2	-6.1	-5.6	-5.4	-2.9	-3.9	-4.8	1.3
Mileage-Based Fee of $0.06/mi	---	---	---	---	-5.0	---	---
Joint Effects	*-29.4*	*-18.4*	*-18.9*	*-28.9*	*-24.2*	*-24.0*	*5.3*
Percentage Change in Regionwide VMT							
Employee Parking Charge of $3	-1.6	-1.8	-1.7	-1.1	-1.9	-1.6	0.3
Congestion Pricing	-2.2	-0.3	-0.7	-1.7	-1.3	-1.2	0.8
Emissions Fee	-0.4	-0.2	-0.3	-0.2	---	-0.3	0.1
Gasoline Tax Increase of $2	-9.7	-8.4	-8.3	-8.1	-7.2	-8.3	0.9
Mileage-Based Fee of $0.06/mi	---	---	---	---	-9.3	---	---
Joint Effects	*-16.5*	*-12.5*	*-12.9*	*-13.1*	*-18.1*	*-14.6*	*2.5*
Percentage Change in Total Regionwide Trips							
Employee Parking charge of $3	-2.0	-2.1	-2.0	-1.3	2.4	-2.0	0.4
Congestion Pricing	-2.2	-0.4	-0.6	-1.6	-1.2	-1.2	0.7
Emissions Fee	-0.2	-0.2	-0.2	-0.1	---	-0.2	0.1
Gasoline Tax Increase of $2	-9.3	-7.8	-7.7	-7.6	-6.7	-7.8	0.9
Mileage-Based Fee of $0.06/mi	---	---	---	---	-8.5	---	---
Joint Effects	*-16.3*	*-12.3*	*-12.3*	*-12.5*	*-17.2*	*-14.1*	*2.4*
Percentage Change in Regionwide CO Emissions							
Employee Parking Charge of $3	-1.7	-1.8	-1.9	-1.2	-2.2	-1.8	0.4
Congestion Pricing	-4.7	-1.2	-2.3	-4.7	-3.0	-3.2	1.5
Emissions Fee	-17.4	-16.0	-16.2	-15.6	---	-16.3	0.8
Gasoline Tax Increase of $2	-9.4	-8.0	-7.8	-7.6	-7.0	-8.0	0.9
Mileage-Based Fee of $0.06/mi	---	---	---	---	-8.6	---	---
Joint Effects	*-42.3*	*-33.4*	*-35.2*	*-36.6*	*-19.0*	*-33.3*	*8.7*
Percentage Change in Regionwide NO_X Emissions							
Employee Parking Charge of $3	-1.6	-1.7	-1.6	-1.2	-1.9	-1.6	0.3
Congestion Pricing	-1.9	-0.4	-0.4	-1.4	-0.9	-1.0	0.7
Emissions Fee	-14.7	-13.6	-14.1	-13.1	---	-13.9	0.7
Gasoline Tax Increase of $2	-9.5	-7.9	-8.0	-7.6	-6.9	-8.0	1.0
Mileage-Based Fee of $0.06/mi	---	---	---	---	-8.6	---	---
Joint Effects	*-34.5*	*-28.9*	*-29.6*	*-28.7*	*-46.9*	*-27.7*	*6.5*

Source: Step Modeling. Baselines: California (1991); Seattle (1994); SOV work trip reductions are estimated outside of the STEP model.

pricing strategy that imposes a flat charge on all employees regionwide has, however, one important disadvantage. In high-density locations, such as the central city, where there is a shortage of on-street parking, drivers cannot easily avoid paying for parking—they have few unpriced alternatives. Thus, parking providers in high-density areas pass most or all of the parking price on to drivers. In low-density locations, such as the suburbs, however, there is an abundance of free on-street parking, and, therefore, drivers can easily avoid paying for parking. Thus, parking providers in low-density areas pass little or none of the parking price on to drivers.

Given these variations, it is not realistic for policy-makers to institute a flat parking fee throughout an entire metropolitan area. For this reason, the researchers also analyzed a parking charge that they decreased on a graduated basis, according to density. To compare this alternative with the flat-fee approach, the research team looked at two different scenarios:

- A flat $5 regionwide fee (parking providers pass the full fee on to drivers) and
- A graduated fee, with $5 applied in the urban core, $2 applied near the core, and $0 in the suburbs (parking providers pass on less of the fee to drivers, on a graduated basis, according to density)

In addition, the researchers included city size and levels of transit service in their assessment. The definitions of these two variables (city size and transit service) are derived from the actual cities used in the analysis—Los Angeles, Sacramento, San Diego, San Francisco, and Seattle. Thus, a "small city" fits the Sacramento example, with a population of 600,000 to 1 million. A "large city" fits the Los Angeles or San Francisco example, with a population of 3 million or more.

Similarly, "transit service" is scaled to the actual cities used in the analysis. San Francisco was used as the reference point for a large, high-transit-service city; Sacramento was used as a benchmark for the small, low-transit-service city;

Los Angeles is a large, medium-transit-service city. The other levels of transit service are interpolations or extrapolations between these benchmarks. Tables 8 and 9 and Figures 15 through 18 present the composite results for the five West Coast areas.

As the tables and figures illustrate, the effectiveness of parking pricing is greatest on the travel behavior of those who reside in the urban core, near core, or suburbs of large cities. For either large cities or small cities, the effect is also greater for travelers who reside in the urban core, regardless of where they work.

As Figure 15 and Table 8 indicate, the effects of a flat $5 regionwide parking fee are the greatest for residents of a large CBD with high transit-service levels, yielding as high as a 36-percent reduction in SOV work trips. Even the effects for suburban residents are high—up to a 10-percent reduction in SOV work trips for residents of small-city suburbs, with low transit service. These relatively large reductions in SOV work trips result from the fact that this model estimates SOV work trip reductions as if it were possible to charge for parking for *all* workplace destinations. It is also assuming that the full $5 parking fee is passed on to all drivers.

The results that Table 9 and Figure 16 display are probably more realistic. In this case, the assumption is that an average of $5 would be passed on to workers in the urban core, $2 to near-core workers, and $0 to suburban workers. This graduated-fee structure takes into consideration the variations in density, discussed above. In this case, the SOV work trip reduction ranges from 31 percent in large CBDs with high levels of transit service to only 2 percent in small-city suburbs with low transit service. Again, this model estimates the effect for *all* work trip destinations; it also estimates the reduction in SOV work trips based on an *average* amount being passed on to drivers (thus in the near core, where an average price of $2 is passed on to drivers, some drivers will pay more and some less). For these reasons, the model may overestimate the actual effect on SOV, because it is unlikely that *all* work trip drivers would in fact pay for parking.

Table 10 and Figure 17 break the analysis down further into a situation where the fees from parking support transit in large cities. The table and figure present two scenarios, one in which all parkers pay (with the price paid graduated according to density) and one in which carpoolers are exempt from paying. The researchers modeled the latter scenario as an example of a policy of preferential parking pricing for carpoolers. As the table and figure indicate, the effect on SOV work trips is greatest when carpoolers are exempt; in addition, the effect is greatest on those who reside in the urban core.

Table 11 and Figure 18 present the same analysis, where parking fees support transit, but for small cities. Again, the effect on SOV work trips is greatest in the scenario in which carpoolers are exempt, although in small cities the difference in the effect when all parkers pay and when carpoolers are exempt is slightly less than in large cities. In addition, SOV work trip reductions are much smaller on average in the small city than in the large city.

Congestion Pricing

The STEP analysis also analyzed four pricing strategies unrelated to parking. One of these, congestion pricing, consists of imposing a fee, conceptually similar to a road toll. Charging could be on a differential basis, so that only certain roads and/or only certain times of usage bear tolls. This analysis assessed the effect of an average price of $0.06 per VMT, or an average of $1.20 per day round-trip work commute, in the five metropolitan areas.

As Table 11 indicates, the researchers estimated congestion pricing to result in an average reduction in regionwide SOV work trips of 6.3 percent. This reduction is second only to the employee parking charge, which, at $3 per day is more than double the average daily amount that people would pay

TABLE 8 Reductions in SOV work trips by variations in transit service and traveler's residence, with a flat $5-per-day regionwide parking charge

	SIZE OF TRAVELER'S CITY OF RESIDENCE					
	SMALL			LARGE		
	Location of Traveler's Residence					
	Urban Core	Near Core	Suburb	Urban Core	Near Core	Suburb
Level of Transit Service	Percent Reduction in SOV Trips					
High	25	19	12	36	26	14
Medium	23	17	11	32	23	13
Low	20	15	10	29	21	11

Source: Data from ECONorthwest, using PUMs data.

TABLE 9 Reductions in SOV work trips by variations in transit service and traveler's residence, with a graduated parking charge, varying by density

	SIZE OF TRAVELER'S CITY OF RESIDENCE					
	SMALL			LARGE		
	Location of Traveler's Residence					
	Urban Core	Near Core	Suburb	Urban Core	Near Core	Suburb
Parking Price Passed on to Workers (Varying by Density)	$5	$2	$0	$5	$2	$0
Level of Transit Service	Percent Reduction in SOV Trips					
High	20	9	3	31	21	8
Medium	18	8	3	28	19	7
Low	16	7	2	25	17	6

Source: Data from ECONorthwest, using PUMs data.

under this congestion-pricing scenario. Although the employee parking charge results in a higher reduction in SOV (9.3 percent), the effect is not double that of congestion pricing, at half the price. Thus, increasing the congestion price to, say, $0.15 per mile, or an average of $3 per day round trip, might have a greater effect on SOV travel than the parking charge.

Another result of the analysis is that the effect of congestion pricing varies widely across the five regions, with the greatest decrease (12 percent) in San Francisco and the smallest (2 percent) in Sacramento. This suggests that congestion pricing may be least effective in small, low-density cities, such as Sacramento, and most effective in large, high-density cities with highly congested corridor travel, such as San Francisco.

Emissions Fees

Two factors determine emissions fees: actual mileage driven and actual emissions of substances such as volatile organic compounds (VOCs), oxides of nitrogen (NO_x), hydrocarbons (HCs), and carbon monoxide (CO). Because the proportion of high-emitting vehicles is small, the monetary amount that the researchers modeled for this analysis averaged only $0.01 per VMT. The emissions fee was not modeled for Seattle.

Unlike congestion pricing or the employee parking charge, the researchers applied this fee to all travel, not just the peak-hour trip. Thus, the average daily amount incurred by travelers would vary according to their average mileage and the type of vehicle used, with operators of high-emissions vehicles being charged more than those of low-emissions vehicles. This fact makes it more difficult to compare the effects of emissions fees with the other strategies, particularly with respect to the effect on SOV work trips. The research team found that a $0.01 per VMT average fee reduces work trips by only 0.1 percent.

However, in terms of polluting emissions, the team estimated the fee to have a much greater effect than any of the other strategies: a 16-percent reduction on average for CO

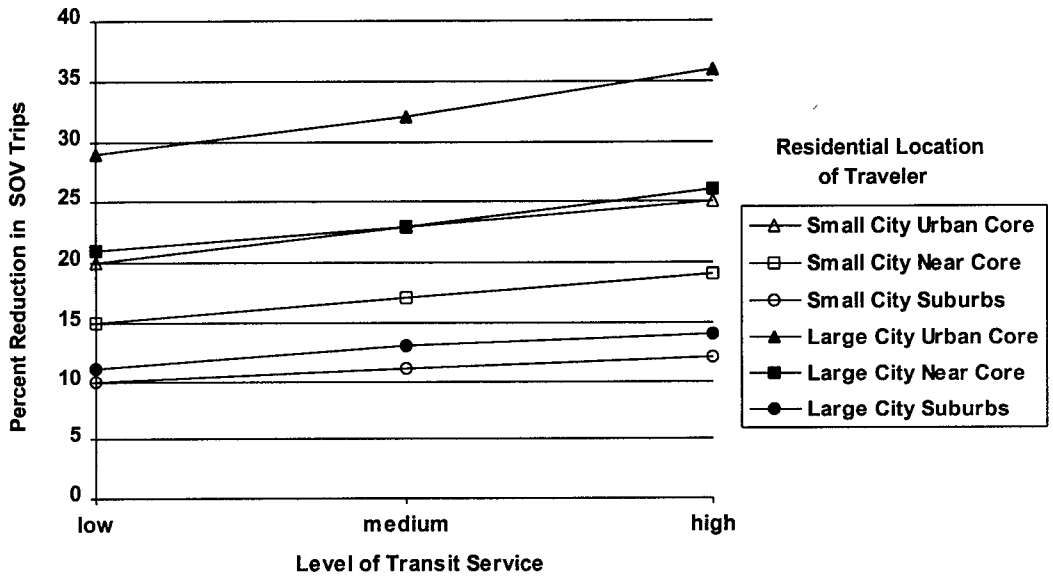


Figure 15. Reductions in SOV work trips due to variations in transit service and traveler's residence, with a flat $5-per-day regionwide parking fee.

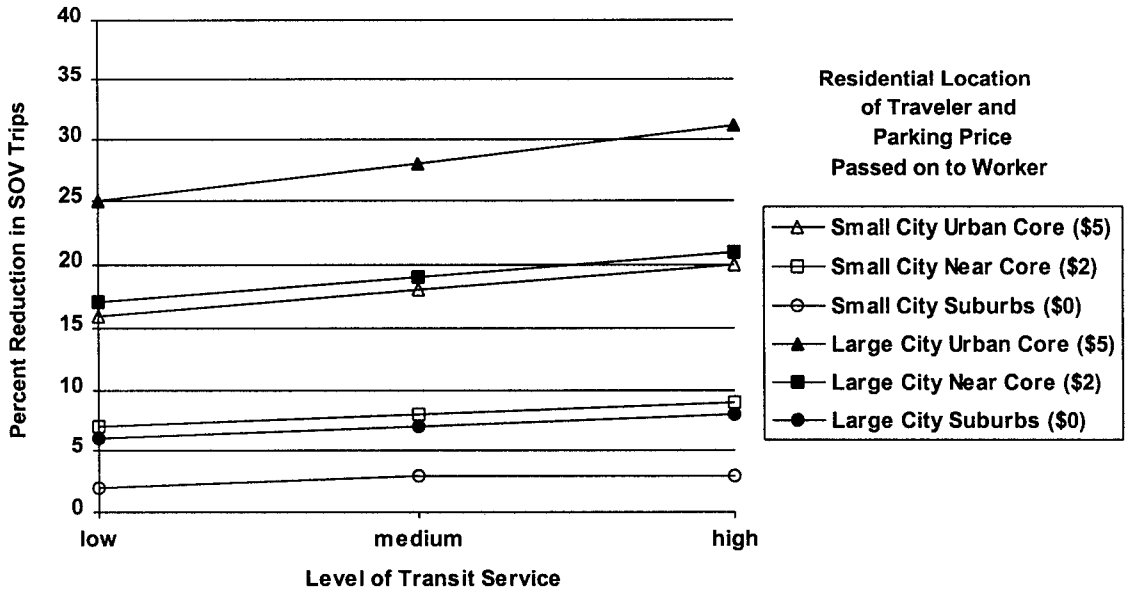


Figure 16. Reductions in SOV work trips due to variations in transit service and traveler's residence, with a graduated parking fee.

emissions and a 14-percent reduction on average for NO_x emissions. These effects were found to be fairly consistent across all five metropolitan areas. The large effects result from the fact that operators of higher emitting vehicles would be charged much more than those of lower emitting vehicles.

Gasoline Tax Increases

The researchers modeled this strategy as a $2-per-gallon increase in the gasoline tax. Like the emissions fee, the gasoline tax would not have a special effect on those who travel in highly congested areas and time periods. This fact minimizes the effect that a gasoline tax increase would have on SOV work trips; the results of the present analysis indicate a 4.8-percent reduction in SOV work trips, which is less than the 6.3-percent reduction that the researchers estimated for the $0.06-per-mile congestion fee. This is particularly noteworthy when, because the average tank gets 22 miles per gallon, the $2-per-gallon increase is considered to translate to $0.09 per mile—$0.03 *more than* the congestion fee. Again,

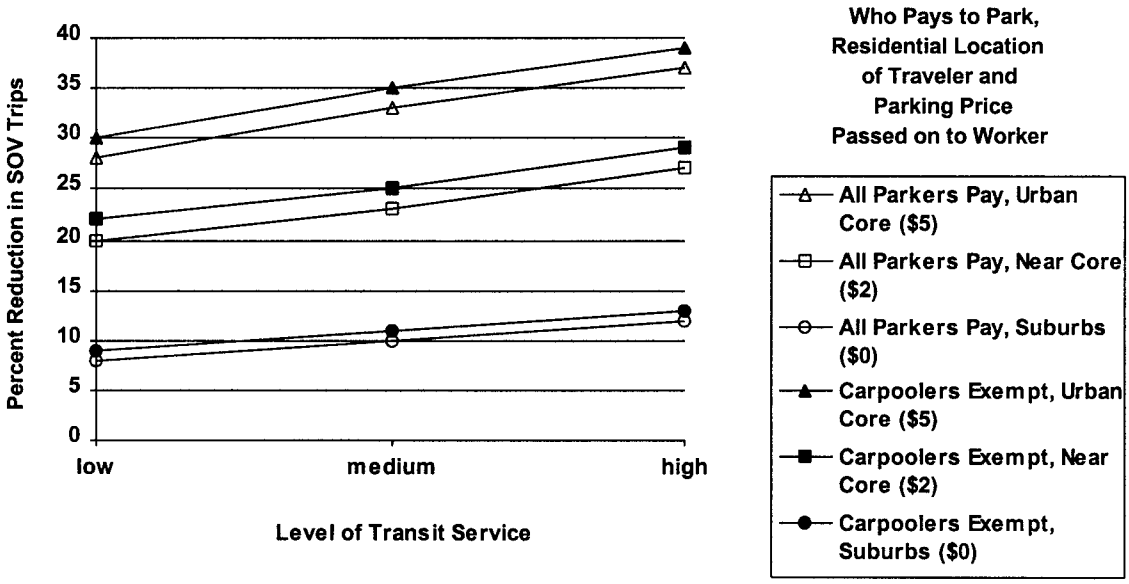


Figure 17. Reductions in SOV work trips due to variations in transit service and traveler's residence, with a graduated parking fee, parking fees used to support transit: large city.

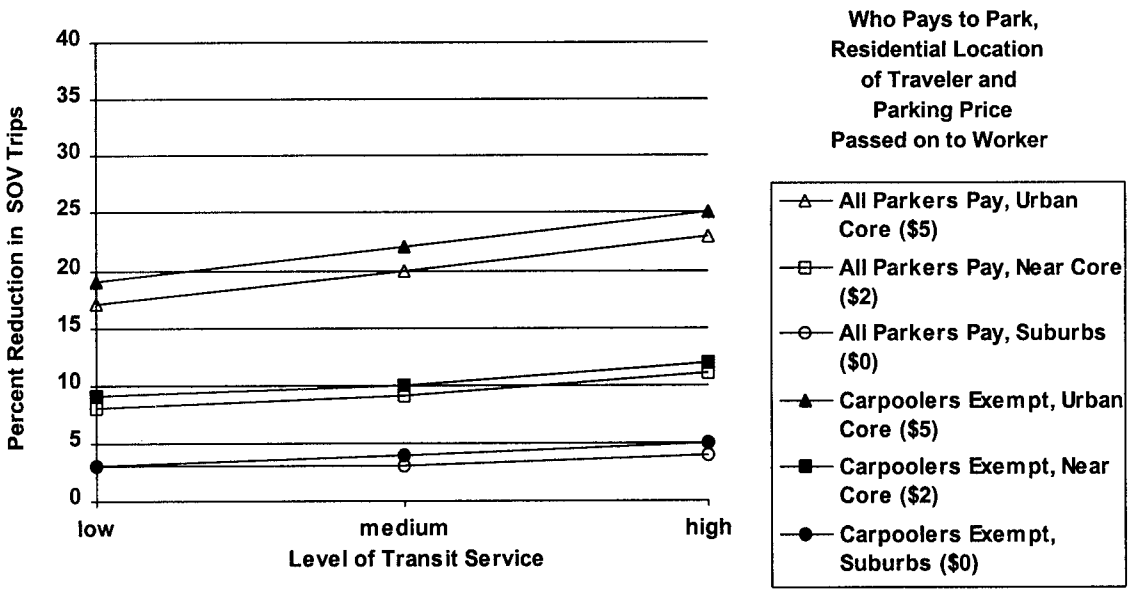


Figure 18. Reductions in SOV work trips due to variations in transit service and traveler's residence, with a graduated parking fee, parking fees used to support transit: small city.

the researchers conclude that the relatively small effect the gasoline tax is estimated to have on SOV work trips is because of the fact that it is not targeted to peak-hour trips, as congestion pricing or employee parking charges would be.

Of the five regions that the researchers modeled, they estimated the gasoline tax to have the greatest effect on SOV work trips in Los Angeles (a 6.1-percent reduction) and the smallest effect in San Francisco (a 3.9-percent reduction). This range suggests that the gasoline tax is most effective in regions such as Los Angeles, where nonpeak travel is relatively heavy, and least effective in regions such as San Francisco, where nonpeak travel may be relatively less important.

Mileage-Based Fees

The researchers analyzed these fees based only on actual mileage driven, not on emissions. The team analyzed this strategy for the Seattle region only, at a rate of $0.06 per vehicle mile. Like the emissions fee and the gasoline tax increase, mileage-based fees are not targeted to congested times or roads. In terms of reducing SOV work trips in Seattle, the researchers found the mileage-based fee to be comparable to congestion pricing (a 5-percent reduction from the mileage-based fee and a 5.8-percent reduction from congestion pricing).

Summary Comments

Although the effects of these pricing strategies are not directly comparable, they illustrate the effectiveness of region-wide strategies and how they might compare with one another in reducing SOV use. One important finding from the analysis of these strategies was that they might have differing effects on various income groups. As is discussed in Chapter 5, parking pricing is likely to have a disproportionately more negative effect on lower income drivers than the other pricing strategies analyzed. Thus, even though the different pricing levels modeled for the pricing strategies in this section prevent direct comparisons of effects, the researchers did identify other important conclusions.

TABLE 10 Reductions in SOV work trips by variations in transit service and traveler's residence, with a graduated parking charge, varying by density, and with parking fees used to support transit: large city

Location of Traveler's Residence	All Parkers Pay			Carpoolers Exempt		
	Urban Core	Near Core	Suburb	Urban Core	Near Core	Suburb
Parking Price Passed on to Workers (Varying by Density)	$5	$2	$0	$5	$2	$0
Level of Transit Service	Percent Reduction in SOV Trips					
High	37	27	12	39	29	13
Medium	33	23	10	35	25	11
Low	28	20	8	30	22	9

Source: Data from ECONorthwest, using PUMs data.

TABLE 11 Reductions in SOV work trips by variations in transit service and traveler's residence, with a graduated parking charge, varying by density, and with parking fees used to support transit: small city

Location of Traveler's Residence	All Parkers Pay			Carpoolers Exempt		
	Urban Core	Near Core	Suburb	Urban Core	Near Core	Suburb
Parking Price Passed on to Workers (Varying by Density)	$5	$2	$0	$5	$2	$0
Level of Transit Service	Percent Reduction in SOV Trips					
High	23	11	4	25	12	5
Medium	20	9	3	22	10	4
Low	17	8	3	19	9	3

Source: Data from ECONorthwest, using PUMs data.

HOW DO DIFFERENT PARKING STRATEGIES COMPARE WITH ONE ANOTHER IN REDUCING WORK TRIP SOV USE?

Introduction

The previous section suggests that parking pricing is an effective strategy for reducing SOV work trips. This section analyzes the effects of three different types of parking pricing programs: increasing the price of parking, based on a tax on parking revenues; increasing the price of parking, based on a tax on parking spaces; and cashing-out employer-provided parking. The researchers analyzed these strategies based on travel data from the Portland, Oregon, region. In addition to estimating the effects of parking strategies, another goal of this analysis was to assess the feasibility of modifying conventional travel demand models to make them better suited to evaluating parking strategies.

General Findings

The Findings section, below, and Tables 12 and 13 and Figures 19 and 20 present the results of this analysis. In general, the research team found that increasing the price of parking results in a decrease in SOV share and an increase in transit share. Of the three pricing strategies examined, the researchers found increasing the price of parking based on a tax on parking spaces to result in the greatest reduction in SOV travel. A large reduction in SOV travel also occurred in areas of high density, such as downtown and other central city business districts, where parking supply is limited and where parking providers can pass parking charges on to drivers.

Methodological Considerations

The researchers used 1985 Portland travel data to estimate the effect of different parking strategies on mode share. They reestimated Portland destination- and mode-choice models for home-based work and home-based other trip purposes to incorporate parking costs explicitly.

The simulation techniques that the researchers used did not allow for precise estimates of specific parking pricing strategies. This is because of the inability of the models to separate parking price from other travel price effects. A chief factor contributing to this inability is the use of zonal average parking prices—the zonal averages are strongly influenced by the large number of zero and missing prices resulting from the fact that so many commuters do not pay for parking.

The research team used several alternative definitions of cost and distance variables with different values in an attempt to find the best model that could include a separate parking cost variable. There was a wide range of undesirable results, including coefficients that were insignificant, carried the wrong sign, or did not have the expected magnitude. The inability to distinguish parking costs from other travel costs

TABLE 12 Comparison of parking strategies: Portland home-based work trips

Strategy	Percent Reduction in SOV Share *Regionwide*	Percent Increase in Transit Share *Regionwide*	Percent Reduction in SOV Share in *CBD*	Percent Increase in Transit Share in *CBD*	Percent Decrease in SOV Share *Near CBD*	Percent Increase in Transit Share *Near CBD*	Percent Decrease in SOV Share in *Activity Centers*	Percent Increase in Transit Share in *Activity Centers*
Increasing the price of parking in the CBD, based on 20% tax on revenues	.04	7	5	14	N/A	N/A	N/A	N/A
Increasing the price of parking, based on $1 tax on parking spaces	1	21	15	40	N/A	N/A	N/A	N/A
Cashing-out employer-provided parking, $3 in CBD and near-CBD, $1 in regional activity centers	.6	9	4	12	2	26	2	29

N/A = not applicable or not modeled

Note: Estimates based on mode- and destination-choice modeling using 1985 travel data from the Portland region.

TABLE 13 Comparison of parking strategies: Portland home-based other trips

Strategy	Percent Reduction in Auto Share *Regionwide*	Percent Increase in Transit Share *Regionwide*	Percent Reduction in Auto Share in *CBD*	Percent Increase in Transit Share in *CBD*
Increasing the price of parking in the CBD, based on 20% tax on revenues	0	0	.02	1
Increasing the price of parking, based on $1 tax on parking spaces	.007	8	2	20
Cashing-out employer-provided parking, $3 in CBD and near-CBD, $1 in regional activity centers	N/A	N/A	N/A	N/A

N/A = not applicable or not modeled
Note: Estimates based on mode- and destination-choice modeling using 1985 travel data from the Portland region.

limits the ability of conventional travel demand models to predict the effects of parking strategies for subareas of a metropolitan region. Because of these methodological drawbacks, the results of the Portland destination- and mode-choice model can be interpreted only with caution.

Findings

Increasing the Price of Parking, Based on a Tax on Revenues

One way to effect changes in parking pricing is through a tax on the revenues earned by providers of parking. This approach would affect only those areas where parking is already priced. As noted above, parking is rarely priced in the suburbs, because of the ample, free on- and off-street parking. Rather, priced parking is generally confined to the CBD and other high-density areas; thus, this parking strategy would apply only to such locations. For this analysis, therefore, the researchers set the model to apply a hypothetical surcharge of 20 percent for all traffic zones with nonzero parking costs, as a way to represent a 20-percent tax on the price of all parking.

The researchers found that this parking pricing strategy has relatively modest effects regionwide and somewhat more impressive effects in the CBD itself. As Table 12 indicates, home-based SOV work trips decrease by only .04 percent throughout the Portland region. This represents a decrease in regionwide SOV share from 78.97 to 78.68 percent. The 7-percent increase in the transit share throughout the region is larger, representing an increase from 3.76 to 4.04 percent. In the CBD, SOV work trip share decreased by 5 percent, or from 60.15 to 57.36 percent, and the transit share increased by 14 percent, from 19.19 to 21.93 percent. Figures 19 and 20 also illustrate these effects. Table 13 shows the results for home-based other trips, which for both the region and the CBD are very minimal.

These relatively modest effects reflect the relatively low costs of parking in Portland and the fact that many drivers do not have to pay for parking. In addition, the 20-percent

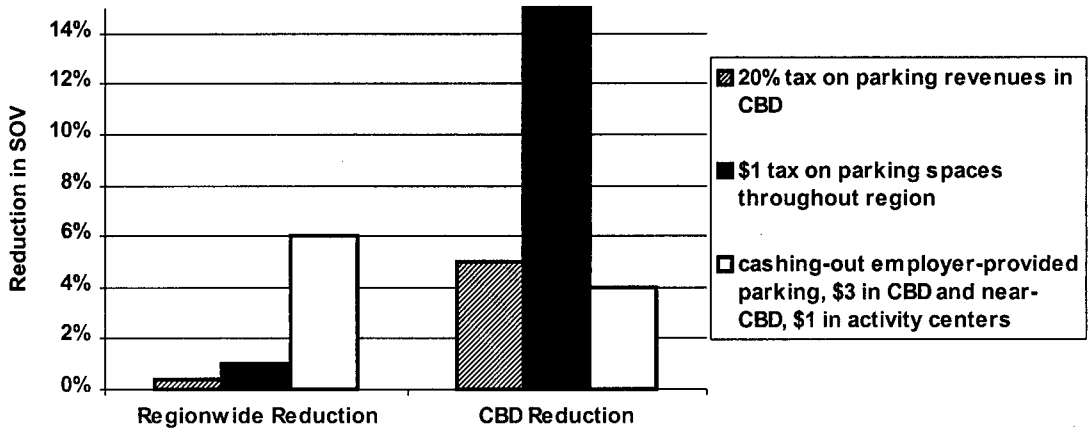


Figure 19. Reductions in Portland home-based worktrip SOV share, throughout region and within CBD, due to three different parking strategies.

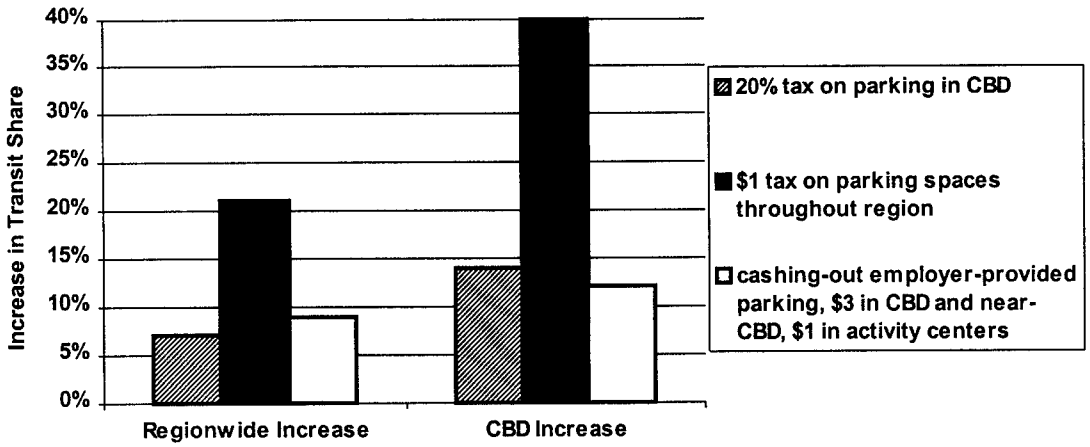


Figure 20. Increases in Portland home-based worktrip transit share, throughout region and within CBD, due to three different parking strategies.

increase is small and increases average daily zonal parking rate of $1.50 by only about 30 cents, to $1.80.

Increasing the Price of Parking, Based on a Tax on Parking Spaces

Another way to influence the pricing of parking is to tax parking spaces. This would have an effect in areas where parking is not currently priced. The researchers modeled the effect of a $1 increase in the average zonal rate of $1.50, thus bringing parking prices up to an average of $2.50. The actual amount would be higher in the CBD and other high-density areas and lower in the suburbs and other low-density areas.

As Table 12 indicates, this strategy appears to have a stronger effect on both reducing SOV and increasing transit share for home-based work trips than either of the other two strategies. Again, the effect is concentrated in the CBD. Regionwide, SOV share is reduced by 1 percent, with a corresponding 21-percent increase in transit share. These percentages reflect a decrease in regionwide SOV share from 78.97 to 78.07 percent and an increase in regionwide transit share from 3.76 to 4.55 percent. In the CBD, SOV share decreases 15 percent, from 60.15 to 51.40 percent, with transit share increasing 40 percent from 19.19 to 26.91 percent. Table 12 and Figures 19 and 20 illustrate these effects on the home-based work trip. Table 13 shows that the effect on home-based other trips, while modest, is also greater with this strategy than with either of the other two.

The relatively large effects of a $1 parking tax on home-based work trips, especially in the Portland CBD, is probably because of the fact that the $1-per-day increase in the Portland CBD is the equivalent of increasing current prices by more than 35 percent. Commuters who currently pay $60 a month for parking would be charged up to $83 a month under this strategy (assuming a maximum of 23 workdays per month), but only $72 under the 20-percent-increase strategy discussed above. The large increase in transit share in the Portland case results, in large part, from the high level of transit service in the CBD. Without adequate transit service, more of the decrease in SOV share might be realized in increases in carpooling, rather than transit.

Cashing-Out Employer-Provided Parking

One parking strategy being considered in several locations is cashing-out, a program under which employees whose employers currently provide free parking would be offered a choice between a taxable cash equivalent or a tax-exempt free parking space. Employees who take the cash could then use it for any purpose, including an alternative transportation mode.

Cash-out programs are generally viable only in situations where employers lease parking. If employers own the parking they provide free to their employees, it is difficult to assign a cost to that parking and, in turn, to pass it on to the employees. If employers lease parking, on the other hand, there is a regular, ongoing rate paid for that parking, typically per month. Thus, if an employer leases ten parking spaces at a rate of $1,000 per month and then provides those spaces free of charge to ten employees, this is the equivalent of the employer paying $100 per month for each employee's parking. If the employers own but do not lease the parking, it is difficult to determine the value of the parking that the employer is providing for the employee.

For these reasons, all cashing-out programs in place in the United States apply to employers who lease parking. Although cashing-out is not currently implemented in the Portland region, the research team analyzed the general scenario of cashing-out employer-provided parking that is leased by the employer at rates of $3 per day in the CBD and near-CBD and $1 per day in suburban activity centers (an activity center is defined as a location with high-density employment). The researchers analyzed these different amounts to take into

consideration the fact that, because of a greater supply of free, on-street parking around activity centers outside of the CBD and near-CBD, they expected the value of parking in those areas to be less than the value of parking within or near the CBD.

There is very little data on the actual proportion of employer-provided parking that is leased; thus, the findings of this analysis must be interpreted with caution. The analysis assumed that a very small percent of all employers in the CBD provide parking and, of these, a relatively large percent lease the parking spaces. In suburban activity centers, the analysis assumed that a larger percent of all employers provide parking, but that, of these, a relatively small number lease the parking spaces. The net effect is that probably no more than 20 percent of all parking spaces are leased in either urban or suburban areas.

Cashing-out leased employer-provided parking at a daily rate of $3 in the CBD and near-CBD and $1 in suburban activity centers was found to have a small effect on regionwide SOV work trip share, reducing it by .6 percent, from 78.97 to 78.50 percent, while increasing regionwide transit work trip share by 9 percent, from 3.76 to 4.08 percent

Within the CBD, the effect of cashing-out was greater, with SOV work trip share dropping by 4 percent, from 60.15 to 57.50 percent, and transit work trip share increasing by 12 percent, from 19.19 to 21.40 percent. The effect on SOV share was smaller in the near-CBD and in activity centers, reducing it by 2 percent in both areas, while increasing transit share by 25 to 30 percent (from 4.62 to 5.83 percent in the near-CBD and from 1.8 to 2.32 percent in activity centers). As cashing-out applies only to work trips, no effect on home-based other trips in the Portland area was modeled.

CHAPTER SUMMARY AND CONCLUSIONS

Although it is not possible to make specific predictions, the findings from the analyses of both the cross-sectional NPTS data and the Portland data suggest that changes in factors related to parking price have a stronger effect on mode choice than do factors related to transit service. In summary, the findings of these analyses, which are largely limited to downtown areas, suggest the following:

- Parking pricing is a more potent tool for decreasing SOV commutes and increasing transit commutes than either increasing transit access or transit frequency.
- Increases in transit share are lower with a combination of high parking prices and low transit service than a combination of low parking prices and high transit service; however, the most effective means of increasing transit share is by increasing parking price *and* improving transit service.
- Increasing transit frequency is a more potent tool for decreasing SOV commutes and increasing transit commutes than is increasing transit access.
- Not all of the decreases in SOV share are picked up as increases in transit, suggesting that carpooling captures some of the SOV decrease; the amount of SOV travel that is diverted to carpooling is inversely related to the level of transit service available.
- For urbanites, raising parking prices at the low end (e.g., from $20 to $30) *increases transit share* more than does raising parking prices at the high end (e.g., from $90 to $100); however, raising parking prices at the high end (e.g., from $90 to $100) *decreases SOV share* more than raising parking prices at the low end (e.g., from $20 to $30).
- Transit use by suburban residents who work downtown is more sensitive to parking price than is transit use by urban residents who work downtown; however, SOV use by suburban residents is less sensitive to parking price than is SOV use by urban residents.
- As the number of bus lines serving a resident increases, transit share increases and SOV share decreases for both urban and suburban residents who work downtown, but suburban residents are less sensitive to increase at the high end (say, from six to seven lines, as opposed to from one to two).

This chapter also looked at how five regionwide travel-pricing strategies affect SOV work trips. For the purposes of this study, the effect of the strategies on SOV work trips is relevant because of the implied effect on transit ridership. As noted in Chapter 1, although only about 26 percent of all travel occurs during the work trip, travel during this period constitutes more than 70 percent of transit's patronage *(8)*. Therefore, the extent to which strategies reduce SOV work trips is strongly associated with the potential those strategies have for increasing transit ridership. Again, the full portion of SOV work trip reduction will not be diverted to transit, because in certain cases (e.g., where existing transit service is poor), carpooling will pick up some percentage of the SOV reduction.

Although the researchers did not compare equal pricing levels for each strategy, some important—though tentative—conclusions regarding the relative effectiveness of these strategies emerge. Employee parking charges and congestion pricing are the most effective strategies in terms of reducing SOV work trips and, hence, increasing transit ridership and carpooling. Although the daily employee parking rate analyzed was, at $3, higher than the average daily congestion fee of $1.20, there is much less variation in the effects of the parking fee among all five regions. This suggests that pricing employee parking may be a more consistently reliable strategy than congestion pricing for reducing SOV work trips and increasing transit ridership and carpooling across different regions.

Levying parking charges on all work trips results in an effect on SOV travel that is unrealistically large, given geographic variation and implementation constraints. Controlling

for place of residence, transit service levels, and density affects the results markedly. Although the effect is greatest in the urban core of large cities, there is a similar effect in the urban core of small cities. In the suburbs, parking pricing has less effect, particularly in the case of a graduated price being passed on to the users.

This chapter also analyzed the effects of three types of parking strategies, using data from the Portland, Oregon, region. Although these findings must be interpreted with caution, in general, the results confirm the findings regarding parking pricing elsewhere in this chapter. That is, increasing the price of off-street parking in the CBD has a greater effect on SOV and transit share than increasing the price in lower density areas. The effect in Portland was slightly less than the effects for a large city with high transit effectiveness and slightly more than the effects for a small city with high transit effectiveness. These findings confirm the conclusion resulting from other analyses in this report—that the effectiveness of parking pricing in terms of reducing SOV work trip travel depends not only on higher densities, but on the extent to which effective transit service is available as an alternative for those who are deterred from parking because of the price.

Finally, this analysis reveals that conventional travel demand models do not perform well in estimating effects of parking policies for two reasons. First, it is difficult to separate the effect of parking charges from other travel costs when few travelers actually face parking charges. Second, the use of traffic zone *average* parking charges is a poor measure of actual parking prices faced.

CHAPTER 5

POLITICAL FEASIBILITY

"Miss Clements, bring in that study of complaints from the field, seven copies," and when she complied the visitors saw the heading: "Complaints from our Ninety-one Directors." . . . It was clear and concise: "Insufficient parking 77, Monotonous food 43, Inadequate health services 23."

Striking the report with his fist, Taggart growled: "They don't give a damn about their own health, but they erupt in fury over a convenient parking space for their car." Jabbing at the areas indicated on the blueprint, he said: "Triple them."

"You mean that much?" Mr. Bingham said. "Look at the scale of that drawing. Those are big spaces."

"Quadruple them, and this time two years from now you'll tell me: 'You were a genius, Taggart.' But do not open shop with only those few parking spaces, or you begin with trouble, big trouble."

—James A. Michener (*35*)

INTRODUCTION

The authors of *Curbing Gridlock: Peak-Period Fees To Relieve Traffic Congestion* describe political feasibility as a complex concept that is a combination of issues such as public acceptance of direct payment for something widely perceived as a free good—like parking—and the fairness to those who are unable to pay for the good without economic hardship (*36*). This chapter discusses the most important issues the research team identified as constituting the "complex concept" of political feasibility. As the authors of *Curbing Gridlock* suggest, equity is one such issue. Equity is, however, itself a complex concept, because parking policy involves issues of both geographic equity, discussed in Chapter 2, and income equity. Interest group (stakeholder) equity is also an important factor. Thus, an assessment of political acceptability involves an identification and discussion of stakeholders—those who have the most to gain or lose through the implementation of parking policy. A discussion of political feasibility should also include consideration of how inequities resulting from a policy might be avoided or mitigated. Finally, political acceptability is a dynamic concept and a discussion of the topic cannot assume that people's attitudes and acceptance levels will not change under different circumstances and over time.

This chapter, therefore, is divided into the following sections, which the researchers believe constitute the most salient factors in an analysis of the political feasibility of parking policy:

- Interest groups and constituencies in the parking policy process,
- The income incidence of parking policy,
- Political acceptance through the allocation of parking revenues, and
- Political acceptance through changing perceptions.

FACTORS IN THE ANALYSIS OF THE POLITICAL FEASIBILITY OF PARKING POLICY

Interest Groups and Constituencies in the Parking Policy Process

Many of the strategies that this report discusses involve a major change in public policy. Such a change in policy requires not only general approval by the public, but also support by powerful constituencies. In a recent discussion of congestion pricing, Martin Wachs concludes that there are few interest groups who currently support that particular pricing strategy, aside from professors of transportation economics and planning, "who hardly constitute a potent political force" (*37*). Genevieve Giuliano also argues that, although the sources of support for congestion pricing are more numerous and stronger than ever before, there is little support among elected officials and the general public (*38*). This section draws on literature about congestion pricing and identifies the various interest groups who may have some stake in parking strategies (*39*). These groups are listed in Table 14.

[35] Michener, J.A., *Recessional*. Random House (1994), p. x.

[36] Transportation Research Board, Commission on Behavioral and Social Sciences and Education, Committee for Study on Urban Transportation Congestion Pricing, National Research Council, *Curbing Gridlock: Peak-Period Fees To Relieve Traffic Congestion*, Vol. 1, Committee Report and Recommendations (1994) p. 58.

[37] Wachs, M., "Will Congestion Pricing Ever Be Adopted?" *Access*, Vol. 4 (1994) p. 16.

[38] Giuliano, G., "An Assessment of the Political Acceptability of Congestion Pricing." *Transportation*, 19 (1992) pp. 335–358.

[39] See especially Small, K., "Using Revenues from Congestion Pricing." *Transportation*, 19 (1992) pp. 359–381. Also see *(Giuliano)*, above.

TABLE 14 Groups with a stake in parking policy

Interest Group	Interests and objectives
Traveling Public	• Reduced congestion and air pollution • Improved mass transit service • Improved roads and highways • Easy access to retail, services, and employment • Low taxes and user charges • Minimal changes in traveling habits
Neighborhood Residents	• No spillover parking • Reduced congestion
Environmentalists	• Reduced air, noise, and water pollution • Increased transit ridership • Limited urban growth and suburban sprawl
Transit Interests	• Increased transit ridership • Increased transit funding • Reduced congestion
Real Estate and Development Community	• Low impact fees
	• Minimal parking requirements • Minimal "trip reduction" requirements
Parking Providers	• Maximum profits: users absorb parking taxes
Retailers and Service Providers	• Easy access • Adequate parking supply • Reduced congestion • Minimal administrative cost of parking provision • Maximum profits: users absorb parking taxes
Employers	• Minimal responsibility for employees' travel behavior • Maximum productivity and profits • No additional costs or taxes • Adequate parking supply • Minimal administrative cost of parking provision
State and Local Officials	• Reduced congestion and pollution • Accessibility of services • Equitable provision of services, including transit and roads • Adherence to federal guidelines
	• Creative financing mechanisms • Public satisfaction
Low-Tax and Minimal-Government Advocates	• Low taxes • No additional taxes • Private supply of facilities • Minimum intervention of and regulation by government

The Traveling Public

This is both the largest constituency and the most difficult to attract in terms of political support. Travelers desire reductions in both congestion and air pollution; easy access to retail, service, and employment; and improvements in roads and highways and the rest of the transportation system, including public transit. However, they generally do not desire these improvements at the cost of significantly higher taxes or user charges. Some very powerful lobbying groups, particularly the American Automobile Association (AAA) and its various chapters, represent the interests of most of the traveling public (*36, 39*).

Neighborhood Residents

Some members of the traveling public are also residents of neighborhoods where spillover parking may affect local streets. Residents generally desire quiet, uncongested neighborhood streets, with plenty of available, vacant on-street parking for themselves and their visitors.

Environmentalists

The environmental coalition is another important stakeholder group. Environmentalists generally have a different agenda from economists and other supporters of transportation pricing, who seek greater efficiency in the transportation market. Environmentalists nevertheless often support efforts to reduce SOV travel, pollution, and sprawl. José Gómez-Ibáñez notes that one factor that may make transportation pricing more politically acceptable is the recent pressure to improve air quality (*40*); thus, environmentalists may be important members of a coalition supporting parking pricing. They generally favor transit improvements and disincentives for auto use to promote a shift to transit.

Transit Interests

Like environmentalists, public transit proponents desire a reduction in SOV use and an increase in transit ridership, but usually for reasons that differ from those of both environmentalists and economists. Like the traveling public, transit supporters also may desire improvements in the transportation system, such as reduced congestion, that will benefit transit's operation. They also desire, however, increased or at least continued high levels of funding support. In this regard, they may have something to gain as potential recipients of revenues raised through the pricing of parking. In general, transit interests consider free parking as an unfair advantage in the promotion of auto use.

Real Estate and Development Community

Realtors and developers have a stake in parking policy because they are often the first to have to comply with parking requirements, not only with regard to the provision of a minimum number of spaces, but adherence to minimal trip-reduction requirements, such as provision of a certain number of carpool spaces or vanpool accommodations. This group will tend to support minimal regulation and low fees and taxes.

Parking Providers

Those who provide parking as a business will have an interest in keeping costs low and demand and profits high. Any policies that increase the cost of parking, such as a tax on parking revenues or spaces, will adversely affect parking providers, who may not be able to pass the full amount of the tax on to consumers. They would also oppose actions that might reduce demand, such as cashing-out programs.

Retailers and Service Providers

This group is interested first and foremost in accommodating customers. While this means an adequate parking supply, it also means easy access—which may involve congestion-reduction strategies, including parking management. This group also has an interest in keeping administrative costs associated with parking provision low. Retailers and service providers would also have to absorb any tax on parking that they cannot pass on to users.

Employers

Like retailers and service providers, employers want to have an adequate supply of parking to accommodate their employees. Their interest in parking is connected to their desire to compete with other employers taking from the same labor pool. But employers usually have limited interest in involving themselves in the transportation decisions of their employees, except insofar as that involvement might increase productivity and profits. Although employers might not want to incur additional administrative costs of parking provision, they may have an interest in doing so to the extent that worker productivity and company profits are improved.

State and Local Officials

Public officials have various interests that, like those of many of the other groups, conflict with one another. On the one hand, they desire policies that make their region, state,

[40] Gómez-Ibáñez, J., "The Political Economy of Highway Tolls and Congestion Pricing." *Transportation Quarterly*, Vol. 49, No. 3 (July 1992) pp. 343–360.

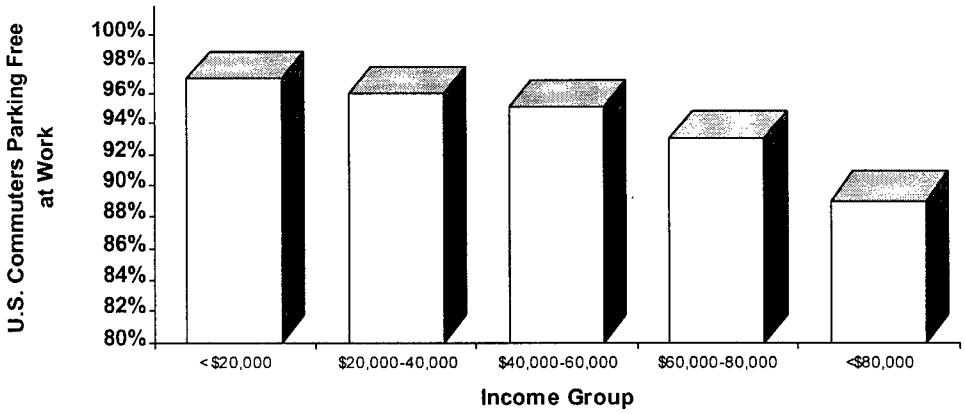


Figure 21. Percentage of U.S. automobile commuters who park free at work by income, 1990.

or locality attractive and competitive with others. This may mean reduced congestion, enhanced accessibility, and an equitable provision of transportation services, including public transit and good highways and roads. These officials also need to achieve these goals with financing mechanisms that the voting public endorses. The difficult task for public officials is to convince the public of the benefits of programs that require new fees or taxes. In addition to meeting the demands of the voting public and its representative interest groups (e.g., AAA), state and local officials also must meet federal mandates and guidelines for receiving federal funds.

Low-Tax and Minimal Government Regulation Advocates

Finally, there is a group whose members may be found in any of the other groups: advocates of low taxes and minimal government regulation. This is a growing coalition in the United States, and its members present a potential threat against any policy that increases regulation, raises taxes or user fees, and restricts freedom of movement in any way.

As the discussion above suggests, each constituency's interests conflict with one another. The fundamental conflict derives from a desire—although not usually articulated as such—for increased efficiency in transportation, but without either increased pricing or regulation. For example, although it is probably true that there is growing support for the *effects* of pricing and regulation (e.g., reduced congestion and pollution), there is also an increase in opposition against the *mechanisms* of pricing and regulation.

The Income Incidence of Parking Policy

Another important issue with respect to political feasibility is how equitable or fair a strategy is across income groups. This question depends in part on the extent to which parking strategies would affect various income groups differentially. There is some disagreement about the manner in and extent to which parking policies would affect different income groups. Some argue that parking pricing policies would impose an unfair burden on the poor, who cannot afford this additional cost. They also argue that parking taxes would be regressive because the poor would have to pay a greater percentage of their income than would higher income drivers. Many economists argue, on the other hand, that market-based approaches are the most efficient way to allocate scarce resources and that, as a group, the poor would not be severely affected by parking pricing because they are less likely to drive and more likely to take transit or to carpool to work. Others point out that those in the lowest income groups are increasingly as likely as the middle- and upper-income groups to drive.

Donald Shoup determined from the 1990 NPTS that the percentage of automobile commuters who park free is in fact *highest* in the lowest income quintile. These data are displayed in Figure 21 *(41)*. Some might argue, however, that the high percentage of low-income commuters parking free at work is the result of "self-selection"—that is, the poor are more likely to drive *if* they are provided with free parking.

In any event, whether or not poor commuters would be affected by a policy depends, of course, on whether or not it is commuters who bear the burden of a price or tax. If commuters do not bear the primary burden, then the direct effect on the poor—as on other income groups—would be minimal. If commuters do not bear the burden of a price, then parking providers, for instance, would. This incidence on providers could, in turn, have an upward effect on the price of goods or a downward effect on land prices.

Figure 22 *(42)* shows the effect of a variable parking fee on SOV travel in Sacramento and Los Angeles for each of five income quintiles. The data are presented in quintiles—rather than specific dollar amounts—as a means of standardizing the income groups; the lowest income quintile in Sacra-

[41] Shoup, D. C., "An Opportunity to Reduce Minimum Parking Requirements." *Journal of the American Planning Association*, 61 (Winter 1995).
[42] ECO Northwest, STEP Modeling, 1991 baseline data, for Census PUMS areas.

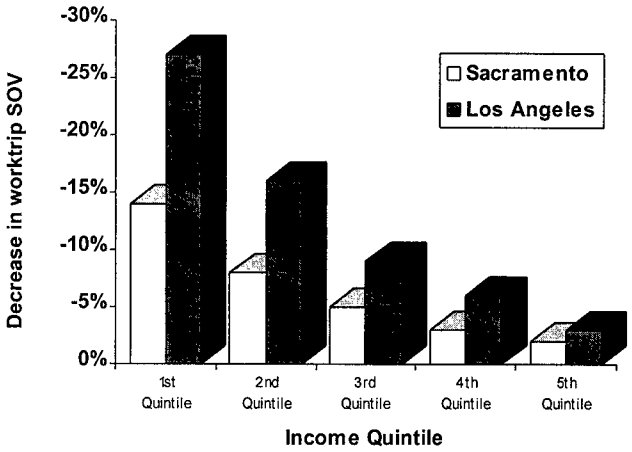


Figure 22. Effects of parking pricing on worktrip SOV by income quintile.

mento is therefore comparable to the lowest income quintile in Los Angeles. The parking fee model used here assumes fees of $3 per day in the central city core, $2 per day in the central city outside of the core, and $0 in the suburbs. As is apparent in the figure, parking prices affect low-income groups more than they do higher income groups.

This is one of the most important findings from the simulations comparing the effects of different pricing strategies across five West Coast metropolitan areas. While low-income travelers are more sensitive than other travelers to any increase in out-of-pocket expenditures, parking charges can have an even more exaggerated regressivity than other pricing techniques—lower income travelers tend to travel fewer miles by car to work, thus making any parking charge more onerous (on a per-mile basis) for low-income drivers than for higher income drivers *(43)*.

Although the data indicate that parking pricing would disproportionately affect low-income drivers, they do not necessarily indicate that such strategies would make low-income drivers disproportionately *worse off*. Some analysts argue that if high prices divert low-income drivers from SOV travel, these drivers are not necessarily made worse off—low-income drivers may not place a high value on the time savings that would result from reduced congestion. However, others, such as Michael Cameron, author of *Efficiency and Fairness on the Road* for the Environmental Defense Fund, conclude that "the distribution of travel reduction is troubling. People in the lowest income groups, who may already be traveling only when most necessary, might forgo essential trips . . . To be equitable, a transportation policy should seek to ensure that essential trips are made—whether under the current system or an alternative pricing scenario" *(44)*. If low-income drivers do not have adequate alternatives, they will continue to drive and to park, despite the financial hardship. Gómez-Ibáñez includes such drivers among his list of those whom a policy makes worse off *(40,* p. 348).

The present study is in agreement with Gómez-Ibáñez in counting travelers who would continue to drive and park despite the relatively low value they may place on time as among those whom a pricing policy negatively affects. Although parking pricing and regulatory strategies might result in decreased congestion and pollution levels that could benefit *all* of society, public acceptance—especially in light of these equity issues—may also depend on compensation for those whom a policy negatively affects. All of the parking strategies this report considers involve pricing parking, and, like congestion pricing, revenues would result. How policy-makers use these revenues may affect the political acceptability of these strategies.

Political Acceptance Through Allocation of Revenues

This analysis assesses political acceptability in terms of the Hicks-Kaldor version of *Pareto optimization* (i.e., the idea that a policy is most efficient when the benefits to those whom a policy makes better off outweigh the costs to those whom it makes worse off, and, furthermore, when those whom the policy makes better off can, in principle, compensate those whom it makes worse off). Compensation of those made worse off is most easily described in terms of the allocation of revenues from pricing strategies.

Kenneth Small proposes that revenues from pricing strategies be allocated in a way that is simple and easy to understand *(39)*. He proposes a three-part plan:

1. Monetary reimbursements to travelers as a group,
2. Substitution for general taxes now used to pay for transportation services, and
3. New transportation services.

Small bases this plan on a principle advocated by Douglas Burtraw for compensating those whom environmental policies make worse off *(45)*. Burtraw develops the idea of "linked compensation," in which policy-makers compensate those whom the policy has harmed by methods that directly alleviate the harm done. Thus, if the biggest loss is monetary, linked compensation would involve monetary reimbursement. Small lists specific measures for compensation that are in line with his three-part plan. The discussion below draws on his measures to suggest how compensating those whom parking policies make worse off might enhance the political acceptability of such policies.

[43] Vincent, M.J., Keyes, M.A., and Reed, M., *NPTS Urban Travel Patterns: 1990 Nationwide Personal Transportation Survey (NPTS).* Prepared for the Federal Highway Administration (1994) p. 3:32.

[44] Cameron, M., *Efficiency and Fairness on the Road: Strategies for Unsnarling Traffic in Southern California.* Environmental Defense Fund (1994) p. 33.

[45] Burtraw, D.R., "Compensating Losers When Cost-Effective Environmental Policies Are Adopted." *Resources,* Vol. 104. Resources for the Future (1991) pp. 1–5.

Monetary Reimbursements to Travelers

Small suggests that local government might use revenues from pricing strategies to subsidize employers who establish a general commuting allowance. More specifically, governments could use the revenues from the pricing of parking to subsidize employer-based cash-out programs. For example, a tax on parking spaces in the CBD is one way to effect an increase in the price of off-street parking. The local government could then use these tax revenues to finance cashing out of employees by those employers who lease parking. If the government realized even greater revenues, it could use them to subsidize cashing out of employees by all employers, even those who do not lease parking. The greatest advantage of this approach is that it would make employees better off by giving them a choice, while not costing employers anything.

Substitution for General Taxes Now Used To Pay for Transportation Services

Governments could use revenues from parking pricing to offset other taxes in several ways. One way is to reduce or eliminate motor vehicle and fuel taxes. As Small notes, the elimination of road-based taxes might appear to undermine the effect of transportation pricing. But, he argues, those taxes are in fact poor proxies for road use, and the effect of the fuel tax in particular is constantly offset by improvements in fuel efficiency. Better taxes on road use include emissions charges, taxes on crude petroleum, and taxes on the carbon content of fuels (*39*). Another way to lower the tax burden is to reduce or eliminate any portion of a sales tax surcharge that the government earmarks for financing transportation. Finally, the government could rebate the portion of the property tax that is used to fund road construction and maintenance. This particular rebate may go a long way in garnering general public support for parking pricing strategies.

New Transportation Services

In a vein similar to Burtraw's idea of "linked compensation," Anthony Downs argues that governments should use the revenues from pricing strategies to finance improvements in the transportation system as a whole; this way, the allocation of the revenues is closely tied with their source, which, he feels, is crucial for enhancing political acceptability (*5*). Small suggests three ways in which the government might use pricing revenues to effect improvements in the transportation system. One way, funding new highway capacity, would make some constituents happy, including much of the traveling public. Environmentalists, however, would probably be opposed to this type of expenditure. A second measure, funding improvements to public transit would, however, appeal to environmentalists, as well as to transit interests and many public officials. As Small notes, improving public transit would be a practical necessity in order to accommodate the increased transit ridership that would result from pricing strategies. Low-tax and minimum-government regulation advocates, however, would probably oppose this type of expenditure; to ward off their objections, policy-makers would need to convince them that waste and inefficiency would not result in the form of transit vehicles running with only a few riders.

A third way that the government could use revenues to improve the overall transportation system is by funding transportation-related facilities and services in certain types of affected areas. Donald Shoup promotes this idea in his discussion of "parking benefit districts" in neighborhoods as a means of encouraging the installation of on-street meters (*46*). Local governments could use the ample revenues from meters, he maintains, to finance neighborhood and area improvements, ranging from sidewalk repair to street landscaping. If applied to activity centers, this approach might result in improvements such as amenities for pedestrians and bicyclists, bus shelters, bus pullouts for easier loading, and even funding of carpooling coordination.

The Bottom Line

There are currently no estimates of the amount of revenue that governments might realize from the various parking pricing strategies. Shoup does estimate that, at a price of $0.50 per hour for 8 hours each weekday, at an 85 percent occupancy rate, one parking space would yield $884 per year. He estimates that two metered parking spaces in front of each house would yield more than the 1991 median property tax of $922 per single-family house. In other words, "even at modest market prices, potential curb pricing revenue in neighborhoods subject to spillover parking could easily exceed current property tax revenues" (*46*).

Small estimates the net benefits resulting from a congestion pricing scenario in Los Angeles, based on a $0.15-per-vehicle-mile congestion fee, for an average peak-hour trip of 10 miles. Most of the parking pricing strategies that this report discusses would result in revenues that would be comparable to, if not more than, that of a congestion pricing strategy. Thus, this section presents Small's projections of net benefits (Table 15) as an example of the net benefits that might result from a parking pricing strategy such as extension of on-street meters and residential permits. (Note: Small's estimates of time savings are for congestion pricing and may be high for a parking pricing strategy.)

The figures in Table 15 are for auto drivers who do not change their mode after pricing has been implemented. Certain assumptions are in place, such as the value of a driver's time, average speed before and after the strategy implementation, and property taxes. The assumptions of parking fees totaling $750 per year (about $2.75 per day, based on 23 working days per month) and nonmonetary benefit of a time

[46] Shoup, D.C., "Cashing in on Curb Parking." *Access*, Vol. 4 (Spring 1994) pp. 20–26.

TABLE 15 Net benefits from auto-pricing policy

	High-Income Auto Driver	Low-Income Auto Driver
Assumptions		
Value of time ($/hr)	8.2	4.7
1-way road distance (mi)	10.0	10.0
Average speed (mi/hr)		
Before	20.0	20
After	30.0	30
Fuel consumed (gal./year)	480.0	320
Sales tax surcharge relative to average household (pct)	1.2	0.9
Property tax relative to average household (pct)	1.7	0.7
Results		
Costs ($/year):	750.0	750.0
Parking fees		
Time savings:		
Amount (min.day)	20.0	20.0
Value ($/year)	686.0	393.0
Monetary benefits:		
cash-out amount equal to $10 per month	120.0	120.0
fuel tax reduced by $0.05 per gallon	24.0	16.0
sales tax surcharge reduced by half	103.0	73.0
property tax rebate equal to all property tax and general fund revenues currently used by local governments for highways	97.0	37.0
Total	344.0	246.0
Net time and monetary benefits: (time + money - costs)	279.0	-111.0
Other benefits ($/year)		
Highway improvements funded by an amount equivalent to 30 percent of funds raised by present dedicated sales tax	64.0	64.0
Transit service improvements funded at 130 percent of the amount needed to absorb the expected diversion from peak travel	32.0	32.0
Transportation-related improvements funded by remainder of revenue	33.0	33.0
Total net benefits	**409.0**	**19.0**

savings of 20 minutes per day underlie the analysis. Monetary benefits come from revenues from the pricing and include a cash-out amount of $10 per month, a fuel tax reduction of $0.05 per gallon, a sales tax surcharge reduction of 50 percent, and a property tax rebate equal to all property tax and general fund revenues that local governments use for highways.

This package of costs and benefits results in a substantial net loss to low-income drivers. However, Small also calculates in other benefits, such as highway improvements, transit service improvements, and general improvements (e.g., parking benefit district amenities suggested by Shoup). As the table indicates, both high-income and low-income drivers would realize a net benefit from this type of approach, which includes a *package* of pricing and compensatory mechanisms. Cameron found similar results based on a $0.05 congestion fee; he included additional benefits, such as reduction in air pollution and estimated changes in costs and benefits because of mode shift. His findings, in fact, showed an even greater net gain for the lowest quintiles *(44)*.

These estimations suggest, therefore, that although pricing strategies may disproportionately affect low-income groups, if governments implement compensatory mechanisms, the net benefit to low-income drivers can be positive. One question that such simulations do not answer, however, is whether other groups whom the strategies might negatively affect would also realize a net benefit. Although members of the traveling public may constitute the largest and most powerful interest group, other groups are also important and may be more vocal than the general public. Policy-makers should consider their concerns, as well. Another issue that compensatory mechanisms may not be able to address is the problem of some essential trips not being made because of pricing constraints. Thus, it is important for policy-makers to consider various solutions in combination, as discussed in Chapter 7, for addressing such issues. For example, TDM programs that provide automobiles for use in case of emergency or other situations can help ensure that essential trips are made.

Political Acceptance Through Changing Perceptions

Compensation of those whom a policy makes worse off may not be the only approach capable of enhancing political feasibility. In fact, conditions of political feasibility may change. In discussing the implementation of impact fees, for instance, Meisner et al. identified a set of politically desirable conditions for instituting a successful transportation program *(47)*. These include existing traffic congestion, which the public and developers perceive as a problem; recent rapid growth and resulting traffic growth, which polarizes a community into promoting a policy of making new development pay; a perceived strong economy, where development tends to occur regardless of fees; support from the business community; and project types that are relatively high density, high cost or "upscale," and generators of high traffic volume. In other words, if negative externalities such as congestion become bad enough and if the economy is strong enough to sustain additional pricing and regulation, political acceptability may increase—even without measures to compensate those whom a policy negatively affects.

A related point is that, although a policy may make some individuals worse off, it may also make society as a whole better off. Many of the positive effects to society as a whole are difficult to quantify and measure. For instance, Table 15, above, does not include benefits accruing because of improvements in air quality. Reductions in SOV travel can have widespread positive effects on society as a whole—and on individuals as a consequence—through the reduction in what economists refer to as "nonmonetary externalities." These are the negative by-products of SOV use that cannot easily be quantified in monetary terms; hence, a monetary compensation approach to improving political acceptability cannot easily take them into consideration.

Mark Delucchi identifies 11 nonmonetary negative externalities resulting from automobile use, which, he notes, are difficult to estimate or quantify *(11*, pp. 7–13*)*. These negative externalities are

- Air pollution;
- Water pollution;
- Noise pollution;
- Global warming as a result of greenhouse gases;
- Extra uncompensated nonwork time because of travel delay imposed on others;
- Price effect of using petroleum fuels for motor vehicles: lost consumer surplus for other oil-producing sectors;
- Pain, suffering, inconvenience, and other nonmonetary costs resulting from motor vehicle-related crimes;
- Land use damage (e.g., habitat and species lost because of highway infrastructure);
- Socially divisive effects of roads as physical barriers in communities;
- Vibration damages; and
- Aesthetics of highways and motor vehicles.

By decreasing SOV trips, parking pricing may mitigate many of the nonmonetary negative externalities listed above, with benefits accruing to all members of society. Thus, although a pricing policy may negatively affect individuals, that same policy can make society as a whole better off, although not, unfortunately, in a way that is easy to measure for purposes of this report. These unmeasurable benefits must be kept in mind, however, when evaluating the political feasibility of policies that may otherwise seem unpopular.

[47] Meisner, J.L., et al., "Public and Private Partnerships for Financing Highway Improvements." *National Cooperative Highway Research Program Report 307*. Transportation Research Board, National Research Council, Washington, DC (1988).

It may take time for society to realize such benefits. In addition, these benefits may be intangible to the individual. This suggests that, although the benefits of nonmonetary externality mitigation may exist, they may not exist immediately or concretely enough to elicit political support. Only when such negative externalities reach crisis proportions may people be willing to support policies that mitigate these negative externalities, even if such policies create hardships—financial or otherwise—for individuals in the short term.

CHAPTER SUMMARY AND CONCLUSIONS

This chapter identified and discussed various issues crucial to an analysis of the political feasibility of parking strategies, especially those that seek to increase pricing.

Political feasibility analysis of parking policies should consider how those policies may affect various stakeholders. The researchers identified 10 constituencies possibly having an interest in parking policy: neighborhood residents, environmentalists, transit interests, the real estate and development community, parking providers, retailers and service providers, employers, state and local officials, low-tax and minimal government regulation advocates, and, not least of all, the traveling public. Each of these constituent groups has different interests, which often conflict and compete with those of other groups; however, the concerns of the traveling public may be the most crucial in terms of political feasibility. Like most of the other constituencies, the members of the traveling public want increased efficiency in transportation without increased regulation or pricing.

The latter issue—increased pricing—is of special interest to those concerned with how different income groups may be affected by parking policies. Many policy-makers and members of the general public worry that pricing policies may negatively affect low-income travelers. The research team concluded that any policy that disproportionately prevents low-income people from making necessary trips is not likely to have a high degree of political acceptability. Similarly, the researchers concluded that if, under a parking-pricing policy, low-income drivers continue to park and drive at prices that are a considerable financial burden, then that policy has a disproportionately adverse effect on those low-income drivers and, thus, can be expected to have low political acceptability.

This chapter identified two general ways in which political acceptability might be enhanced. One is through allocating revenues gained from pricing strategies so as to compensate those whom the strategies have made worse off. Mechanisms for allocating these revenues include making monetary reimbursements to travelers (e.g., by subsidizing cashing-out programs); substituting parking pricing for general taxes (e.g., portions of the property tax now used to finance transportation services); and using the revenues to provide new transportation services, including enhanced public transportation, which would be a necessity if parking pricing policies were indeed to have the intended effect of diverting travelers from SOV use.

A second way that political acceptability might be enhanced is through time itself. That is, if policy-makers do not adopt new policies now and if congestion and environmental conditions continue to worsen, policy-makers and stakeholders may change their attitudes about the acceptability of pricing parking. If the economy is robust enough to withstand additional fees, the political acceptability of pricing measures may increase, even if revenues are not allocated so as to compensate those whom such measures might make worse off. In addition, political acceptability might increase over time if more people are willing to compromise in individual well-being for advances in societal well-being, particularly in terms of the environment. Although this last possibility seems unlikely, the necessary changes in attitudes and general conditions might occur.

CHAPTER 6

ASSESSMENT OF PARKING STRATEGIES

INTRODUCTION

The discussion in the previous chapter suggests that, although there may be difficulties in achieving political acceptability for individual parking strategies, it may be possible to compensate those made worse off, thereby enhancing political acceptability. Other issues, however, also affect whether a parking strategy may be appropriate or not. Ease of implementation, overall effectiveness, and scope (i.e., how targeted or comprehensive the strategy is in its aim) are examples. This chapter evaluates several parking strategies in terms of effectiveness, scope, political feasibility, economic efficiency, and ease of implementation.

Although the researchers evaluated eight strategies as individual policy approaches, it is not recommended that policymakers implement any strategy on an individual basis. Rather, the strategies should be part of more comprehensive parking policy packages that include individual parking strategies, as well as complementary devices, such as improvements in transit service.

The strategies evaluated are divided into two categories: price based and nonprice based. The price-based strategies consist of parking pricing approaches, mentioned earlier in this report. The research team was able to express these strategies quantitatively and thus model their effects, as presented in Chapter 4. These strategies include

- Increasing the price of parking, based on a tax on revenues,
- Increasing the price of parking, based on a tax on parking spaces, and
- Cashing-out employer-provided parking.

This chapter discusses two other price-based strategies, although the research team did not model their effects:

- Expanding meters and accompanying residential permit programs and
- Parking impact fees.

The nonprice-based strategies that this chapter presents, whose effects also were not modeled by the researchers, include the following:

- Changes in zoning ordinances to restrict parking supply;
- Shared parking; and
- TDM approaches, consisting of satellite parking-shuttle lots, preferential parking for carpoolers, and transit incentive programs.

Assessment Criteria

The researchers assessed both the price-based and nonprice-based parking strategies in terms of effectiveness, scope, political feasibility, economic efficiency, and implementation issues. The following sections discuss the criteria used to assess these factors.

Effectiveness Criteria

The research team evaluated the strategies with respect to the extent to which they expected them to decrease SOV work trip share and increase transit work trip share. The team used a qualitative assessment scale: "high," "moderate," and "low." The team did not model most of the strategies quantitatively—the assessment of the effectiveness of these strategies is limited to a subjective evaluation based on the research team's experience and related literature, such as Anthony Downs's *Stuck in Traffic* (*5*). The researchers derived the ratings of high, moderate, and low from the findings resulting from the analysis of those strategies that were modeled quantitatively, as presented in Table 12 in Chapter 4. Table 16 presents the criteria for assigning these ratings.

Scope Criteria

"Scope" refers to a strategy's target, that is, both what percentage of travelers it affects and how narrow or broad the range of travelers is. The researchers rated the strategies in terms of three types of scope: *temporal* scope refers to the extent to which the strategy targets peak-hour drivers specifically; *functional* scope refers to the focus of the target in terms of type of driver or trip type; *spatial* scope refers to the geographical range of a strategy (i.e., whether officials apply the strategy broadly throughout a region or on a more limited basis, such as at a given worksite or in a given district). For each type of scope, the definitions in Table 17 provide the basis of the ratings of "broad," "moderate," and "narrow."

TABLE 16 Criteria for rating parking strategies' effectiveness in increasing transit worktrip share regionwide

Effectiveness Rating	Expected Increase in Transit Work Trip Share Regionwide
Low	0-4 percent
Moderate	5-10 percent
High	Greater than 10 percent

Political Feasibility Criteria

The team assessed the political feasibility of each strategy with respect to the following criteria:

- The extent to which a strategy would make the interest groups identified in the previous chapter better or worse off;
- The extent to which resulting revenues can compensate those whom a strategy makes worse off, as discussed in the previous chapter; and
- The extent to which a strategy may make society as a whole better off, thus counteracting short-term negative effects on individuals or specific interest groups.

The researchers assigned political feasibility ratings as "high," "moderate," or "low." Table 18 defines these ratings.

Economic Efficiency Criteria

As discussed earlier, one way in which a pricing or regulatory strategy is justifiable is if it addresses a failure in the transportation market. In economic terms, the extent to which a strategy corrects a market failure—or, internalizes a negative externality—is referred to as "efficiency." The researchers evaluated the strategies in this report in terms of their potential to correct negative externalities, if any exist.

The efficiency of a strategy is related both to its pricing level and to its scope. For example, in terms of pricing level, a strategy is inefficient if the price is either inappropriately high or inappropriately low. If a price is too high, the number of diverted auto drivers may be so high as to cause problems elsewhere in the transportation system. Similarly, if it is too low, there may be no effect on mode shift. As for scope, broad strategies tend not to be efficient because they do not target the source of the negative externality. The extent to which a strategy generates any new negative externalities also affects efficiency (e.g., a strategy that is liable to create additional spillover parking is not very efficient). Similarly, a strategy that is liable to create negative long-term effects on urban structure (e.g., decentralization) is also not efficient. The researchers rated each strategy as "high," "moderate," or "low." Table 19 defines these ratings.

Ease of Administration and Implementation

The researchers based the implementation issues in this chapter on five studies that they conducted to provide illustrations

TABLE 17 Criteria for rating parking strategies' scope

Scope Rating	Definition
Broad	• *Temporal*: the strategy is not aimed specifically at peak-hour drivers • *Functional*: the strategy does not target specific drivers or trip types • *Spatial*: the strategy targets a wide geographic area and is not limited to a given site or district
Moderate	• *Temporal*: the strategy is aimed at a subset of peak-hour drivers • *Functional*: the strategy is not particularly targeted toward certain drivers or trip types • *Spatial*: the strategy is not targeted to a particular geographical area
Narrow	• *Temporal*: the strategy is aimed specifically at peak-hour drivers • *Functional*: the strategy targets a very specific group of drivers or trip types • *Spatial*: the strategy targets a narrow geographic area or is limited to a given site or district

TABLE 18 Criteria for rating parking strategies' political feasibility

Political Feasibility Rating	Definition *(most or all attributes in each rating category must apply)*
Low	• A relatively large number of interest groups or individuals are made substantially worse off • Few revenues result with which to compensate those made worse off • Expected benefits to society as a whole are minor
Moderate	• A moderate number of interest groups or individuals are made somewhat worse off • Moderate revenues result with which to compensate those made worse off • Expected benefits to society as a whole are moderate
High	• Relatively few interest groups or individuals are made worse off • Substantial revenues result with which to compensate those made worse off • Expected benefits to society as a whole are great

of some of the strategies that policy-makers are implementing throughout the United States. These studies are as follows:

- A study of parking policy in 20 central cities (*23*);
- A study of parking policy in 11 edge cities (*48*);
- A case study of parking policy in Portland, Oregon (*48*);
- A case study of parking policy in midtown Atlanta, Georgia (*47*); and
- A study of parking procedures at several universities and hospitals (*27*).

This chapter discusses implementation issues associated with the strategies, but the researchers have not assigned any rating with respect to implementation. They did, however, rate strategies with respect to ease of administration, as defined in Table 20.

Table 21 describes these case studies.

ASSESSMENT OF PRICE-BASED PARKING STRATEGIES

This section provides an assessment of five price-based parking strategies:

- Increasing the price of parking, based on a tax on revenues;
- Increasing the price of parking, based on a tax on parking spaces;
- Cashing-out employer-provided parking;
- Expanding meters and accompanying residential permit programs; and
- Parking impact fees.

Increasing the Price of Parking, Based on a Tax on Revenues

Definition

One way to stimulate pricing of parking is to tax the revenues that parking providers generate. The economic rationale for this tax is to impose on motorists the social cost of driving, in addition to the private cost. As discussed previously, this strategy would target providers who currently realize revenues, (i.e., those in the CBD and other high-density areas). Parking providers in the suburbs and other low-density areas do not charge for parking and, hence, do not realize revenues.

Effectiveness

The researchers expect a parking tax to have a moderate effect on increasing transit ridership, although the effects of this strategy would vary according to whether the price increase is occurring in an area with high transit service or in an area with low transit service. The effects would also vary depending on the size of the tax.

[48] Forthcoming discussion paper, Center for Urban Studies, Portland State University.

TABLE 19 Criteria for rating parking strategies' efficiency at internalizing negative externalities

Efficiency Rating	Potential for Improving Efficiency *(most or all attributes in each rating category must apply*)
Low	• Strategy is broad in scope • Inappropriate (too high or too low) in magnitude • Likely to create additional negative externalities such as spillover parking or undersupply of parking • Likely to result in decentralization over the long term
Moderate	• Strategy is moderate in scope • Moderate in magnitude • May create additional negative externalities such as spillover parking or undersupply of parking • May result in some decentralization over the long term
High	• Strategy is narrow in scope • Appropriate in magnitude • Unlikely to create additional negative externalities such as spillover parking or undersupply of parking • Unlikely to result in decentralization over the long term

Scope

The temporal scope of this strategy is broad, because it is not aimed specifically at peak-hour drivers. This strategy would affect only those drivers who currently pay to park, making the functional scope fairly narrow. Its spatial scope is also fairly narrow because the strategy would apply only to those denser locations where parking is already priced.

Political Feasibility

This strategy is expected to have moderate political feasibility.

In general, travelers would benefit from a decrease in travel and parking congestion resulting from a moderate increase in transit share. Because only a small percentage of all peak-hour drivers would be affected, actual pollution reduction would probably be minimal; nevertheless, environmentalists

TABLE 20 Criteria for rating parking strategies' ease of administration

Ease of Administration Rating	Definition
Low	Implementation is very costly *and/or* requires major new technology, procedures, agencies, institutions, or legislation
Moderate	Implementation is somewhat costly *and/or* may require some new technology, procedures, agencies, institutions, or legislation
High	Implementation incurs little additional cost *and/or* requires little or no new technology and few or no new agencies, procedures, institutions, or legislation

TABLE 21 Studies conducted to provide background on implementation of parking strategies

Study of Parking Policy in 20 Central Cities To assess the nature of parking policies already in place throughout the U.S., the research team surveyed officials in the central cities of 20 metropolitan areas. The surveys, conducted by telephone, focus on parking policies in place in CBDs. The researchers addressed four key areas: parking regulation, especially zoning requirements and parking taxation; publicly owned CBD parking facilities; parking meters; and neighborhood permit programs. Chapter 3 also presents a discussion of this study *(23)*.
Study of Parking Policy in Eleven Edge Cities To provide information about parking policies in noncentral locations in the U.S., the researchers surveyed officials in eleven edge cities, asking the same types of questions that were asked of officials in the 20 central cities. Chapter 3 also presents the findings from this survey.
Case Study of Parking Policy in Portland, Oregon Because Portland, Oregon, has been implementing a wide range of parking strategies for over two decades, the researchers considered Portland an important example of how parking strategies are implemented and what the results of those strategies are. The research team conducted interviews of local officials and public and private providers of parking.
Case Study of Parking Policy in Midtown Atlanta The researchers chose Midtown Atlanta as a case study because, like edge cities, it is an example of new development occurring outside of a CBD. In Midtown Atlanta, Special Public Interest Districts (SPIDs) have been in place to attract new development. Buildings inside the SPIDs need not have any parking facilities and can be developed more intensively than buildings located outside SPIDs. The research team conducted interviews of officials in the Midtown Atlanta area. Chapter 3 also presents a discussion of this case study *(27)*.
Study of Parking Procedures at Universities and Hospitals The research team studied several urban universities and hospitals as examples of "special parking generators," which serve a large number of people, both employees and consumers. Parking demand is great at these institutions, although supply is usually very limited. As a result, these institutions often employ various parking-management strategies, which the researchers considered instructive in providing examples of implementation issues. The team conducted interviews of parking managers at a number of these institutions—including two hospitals in Portland and several urban universities in Oregon, California, and Washington.

would probably endorse this strategy, as would transit interests and local officials who are concerned about improving access to the CBD. Those made worse off would be auto users who cannot afford the price increase (e.g., low-income people who drive to and park in the CBD); employers, retailers, and service providers in the CBD who might oppose additional constraints on parking; local officials worried about higher user fees in the CBD; and low-tax and minimal government advocates.

Depending on the level of the tax, policy-makers could use the revenues from this strategy to compensate those made worse off if the administrative costs associated with identifying and compensating those individuals and groups did not outweigh the benefits of doing so.

This strategy would make society as a whole only minimally better off, because it would mitigate nonmonetary negative externalities such as pollution only slightly.

Economic Efficiency

Because CBD firms and commuters would be at a disadvantage relative to the suburbs—where this strategy would not apply—this approach could stimulate decentralization over the long term. Another problem is that there would almost certainly be spillover parking into unmetered on-street spaces. For these reasons, this tax has low to moderate economic efficiency. This strategy's economic efficiency could be further compromised if the tax is set too low or too high. If set too high, it would cause a shift from SOV in the short term but encourage decentralization in the long term. If the tax is set too low, the modal effect would be slight and the only effect would be the resulting revenues.

Ease of Administration and Implementation

One-half of the cities included in the survey of parking policy in 20 central cities impose a tax on parking revenues; in about one-half of these, the tax is an application of the regular sales tax. Six central cities—New York, Los Angeles, Chicago, San Francisco, Philadelphia, and Pittsburgh—apply parking taxes of 10 percent or more of revenues. At 28 percent, the taxation rate in Pittsburgh is the highest of any of the cities surveyed.

These parking taxes apply only in situations where a transaction occurs, either between a driver and a parking operator or between a business and a parking operator. In none of the surveyed cities do officials levy a tax on drivers when the parking is free, and no city attempts to tax the portion of office lease payments that secure parking spaces for tenants.

The tax on parking revenues appears to be primarily for revenue generation and is largely unrelated to transportation policy in general. In most cities, parking policy is not well developed, nor is it related to transit policy. Thus, although taxing parking revenues is a strategy that some city officials employ, they do not do so in the manner this report suggests (i.e., as a policy aimed at increasing parking prices and reducing SOV share). Indeed, cities are not currently taxing parking revenues at a rate high enough to stimulate the pricing of parking or cause a mode shift; most—if not all—parking revenue taxes are part of a larger sales tax with no other goal than revenue generation, and officials do not use the revenues from the parking taxes to compensate those made worse off or to finance general improvements in the overall transportation system.

The ease of administration of this strategy is moderate to high. Although little new technology would be needed, the approach does require that a monetary transaction occur, so mechanisms need to be in place for handling that transaction. Some new agencies and procedures may be necessary, as well, for levying, collecting, and enforcing compliance with the tax.

Increasing the Price of Parking, Based on a Tax on Parking Spaces

Definition

Another way of stimulating parking pricing is by taxing actual parking spaces, rather than revenues. Such an approach would affect all parking, not just that in high-density areas where parking is currently priced.

Effectiveness

In the CBD, where there are few opportunities for spillover parking, the researchers expect that parking providers will pass a large percentage of the tax on to drivers; the effect on increasing transit share should be high—higher than any of the other strategies analyzed. In the central city and suburban business districts, where there are more opportunities for spillover parking, the researchers expect providers to pass less of the tax on to drivers; the effect on transit would be relatively low, particularly if the available transit service is not of very high quality. In business districts outside of the CBD, travelers may be more inclined to switch to carpooling rather than transit.

The effectiveness of this tax depends on how high it is. Political concerns may result in lowering the level of the tax and increasing the number of exemptions. These actions would minimize the effectiveness of this strategy while increasing the administrative costs involved with managing exemptions.

Scope

This strategy is broader in its aim than the tax on parking revenues. Although it might affect a larger percentage of peak-hour drivers, it is not aimed specifically at that group.

Instead, it would affect *all* drivers who park in the CBD or other central city or suburban business districts. This strategy, thus, has a broad temporal, functional, and spatial scope.

Political Feasibility

This strategy is expected to have low political feasibility.

Those whom this strategy makes worse or better off are similar to those whom the tax on parking revenues would affect, except on a broader basis: they would include all travelers to both central city and suburban business districts, as well as to the CBD, where the parking providers could pass the tax on to drivers. The effect would also be more extensive, and, thus, this strategy would be more effective in reducing SOV share and increasing transit share. Therefore, while this strategy would make those who benefit from reductions in congestion much better off than under the previous strategy, it would make those who cannot afford the price increase or who oppose increased taxes much worse off. In addition, the differential effect resulting from variations in density would affect drivers parking in high-density areas more strongly than those in low-density areas. Another negative effect would be on parking providers in low-density areas who are unable to pass the tax onto motorists and who therefore have to absorb it.

Although it still might be difficult to identify and target those made worse off for compensation, the effectiveness of this strategy, combined with the moderately high revenues that would result, would probably make such an endeavor worthwhile (although, there may be severe administrative difficulties). Thus, low-income drivers who would be priced away from driving might not be as negatively affected if policymakers used the parking fees to improve transit service.

Society as a whole would realize greater benefits in terms of mitigation of nonmonetary negative externalities than would be the case with the tax on parking revenues. This is, again, because of the greater effect on SOV reduction.

Economic Efficiency

Like the tax on parking revenues, this strategy would stimulate decentralization over the long term, as CBD employees and firms would find suburban locations more attractive, though this effect might be offset if firms had to absorb a larger proportion of the tax in such areas. Another drawback to this approach is that it would result in spillover parking onto unmetered on-street spaces. This strategy is also broad in scope. Thus, its economic efficiency is low. Again, if the tax is too high in magnitude, the resulting SOV reduction could compromise efficiency by creating more distortions than it would correct. If the tax is too low, it would have little modal effect.

Ease of Administration and Implementation

The case studies also illustrate potential problems with a tax on parking spaces. None of the 20 surveyed cities levies a per-space tax. There are two possible explanations for this. One is that, unlike a tax on parking revenues, a tax on parking spaces would not be part of an existing sales tax; thus, this strategy would require a new tax. Implementation impediments might also arise because of the differences in incidence between the central city and the suburbs: parking providers may be more likely to pass a tax on off-street spaces on to drivers in the high-density CBD but may be more likely to absorb the tax in the low-density suburbs.

There are also practical obstacles involved with administration of a per-space tax. The case study of parking policy in Portland demonstrates the difficulty of conducting an inventory of parking spaces. Metro, the regional planning agency in the Portland metropolitan area, is trying to achieve a 10-percent reduction in parking spaces over the next 20 years, as mandated by the state's 1991 Transportation Planning Rule. As a first step in achieving this reduction, Metro recently attempted a baseline inventory of all parking spaces throughout the region. Numerous problems emerged during the inventory effort (e.g., difficulty in counting structured off-street spaces [surveyors could more easily count surface lots and on-street spaces through the use of aerial inventorying methods], achieving standardized space counts for unmarked lots, exempting streets where parking is not allowed and lots used for fleets or auto sales, and counting parking spaces used on a temporary basis). The Portland case is instructive in warning of the difficulty of obtaining an accurate count of spaces; property tax assessors would have to incorporate a count of parking spaces into their procedures to stand scrutiny as a basis for taxation.

The ease of administration of this strategy is low. This tax would require new legislation; existing legislation authorizing a sales tax would not be adequate, because this tax would not be based on a monetary transaction. Implementation of this tax would also require new agencies and procedures for counting spaces and levying, collecting, and enforcing compliance.

Cashing-Out Employer-Provided Parking

Definition

Cashing-out employer-provided parking is a strategy whereby employers would give their employees the cash equivalent of any parking benefit provided, and employees could then either spend that cash toward paying for the parking (rather than continuing to receive it free) or spend it toward any other purpose, including transit. Current legislation limits cashing-out to employers who lease parking, because it is easier to impute a cash value to that parking than to parking that the employer owns. The cash-out amount is also limited only to those employees to whom employers

currently offer parking, not to *all* employees. For example, if an employer currently offers free parking only to executives and not to other employees, a cash-out program would require that employer to offer the cash-out amount only to the executives and not to others.

Effectiveness

Some studies have estimated very optimistic effects on transit as a result of cashing-out strategies. These studies, however, have focused on the estimated effects for a given site, such as an individual employer (*49*). This research team's simulations estimated effects on work trip transit ridership for the entire Portland metropolitan area. The analysis predicted separate transit effects as a result of cashing-out both leased employer-provided parking and *all* employer-provided parking. The results suggest that moderate increases in regional transit ridership would result from either type of cashing-out. The relatively modest effects for leased parking are because only a small percentage of employer-provided parking is leased; further, good data on the amount of leased parking are scarce and difficult to collect.

Scope

Cashing-out targets employee parking; thus, the temporal scope is narrow, primarily affecting peak-hour traffic. If cashing-out is limited to leased parking, the functional scope is also fairly narrow, because this strategy is aimed specifically at commuters who park in leased spaces. The spatial scope is narrow as well, because the strategy would apply to individual employment sites within a region, although only those where employers lease parking—primarily in high-density areas, where third-party parking providers supply parking.

Political Feasibility

Cashing-out has moderate political feasibility.

That most proposals for cashing out focus on parking that the employer leases and that most leased parking is in the CBD—where market rates are also their highest—has some effect on which groups this strategy makes worse or better off. All employees to whom employers offer the cash-out option would be better off because they would have a choice they did not have before.

Those who would benefit from the slight reduction in congestion are also among those whom cashing-out makes better off, even if they are not among those who have the cash-out option. Assuming that this strategy would apply only to leased, and therefore primarily CBD parking, these beneficiaries would include travelers to the CBD whose time is highly valued, transit interests, and local officials concerned with improved access to the CBD. Because of better transit service in the CBD, cashing-out may encourage centralization over the long run, and local officials and CBD retailers may benefit from this centralization. Although the reduction in air pollution would not be great, environmentalists would also benefit from this strategy if increased centralization means reduced sprawl; the strategy would also reduce SOV travel slightly. Employers who have to cash-out employees to whom they previously offered free parking but who did not use it (e.g., transit users) constitute the primary group made worse off; the administrative costs associated with cashing-out may also be disadvantageous to employers, as would the effect of increasing salaries to compensate employees for the loss of the tax exemption. On the other hand, employers would benefit to the extent that they would be able to supply less parking (and hence reduce their costs) when the demand for parking decreases as employees shift from SOV to carpooling or transit.

No revenues would result from cashing-out with which to offset the negative effects to those whom cashing-out would make worse off; cashing-out is, in fact, designed to be revenue neutral.

Benefits to society as a whole would be only moderate if this strategy is confined to leased parking because the effects on pollution and other nonmonetary negative externalities would not be significant.

Economic Efficiency

Cashing-out is more efficient than the previous two strategies. Unlike the case with the parking pricing strategies discussed previously, cashing-out *all* employer-provided parking (not just leased parking) might actually stimulate centralization over the long term. This is because, although cashing-out would make all parking users—in the suburbs as well as in the central city—more aware of the actual costs of parking, central city users would have better alternatives to parking to which to turn (i.e., transit). In this case, the central city location might become more attractive to employers and employees. However, spillover parking would remain a potential problem, particularly in the suburbs, because those commuters who chose not to park in the employer-provided spaces might park for free on streets in nearby residential areas.

Cashing-out is narrower in scope than the previous two and affects only a small percentage of all commuters. Although some spillover parking may result, cashing-out is designed to generate few other negative externalities. Its economic efficiency is moderate.

[49] Shoup, D.C., and Willson, R.W., "Employer-Paid Parking: The Problem and Proposed Solution." *Transportation Quarterly*, Vol. 46, No. 2 (April 1972) p. 172. Also, Shoup, D.C., "Cashing Out Employer-Paid Parking: A Precedent for Congestion Parking?" In National Research Council, Transportation Research Board, Committee for Study on Urban Transportation Congestion Pricing, *Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion*, Vol. 2. National Academy Press (1994) p. 156.

Ease of Administration and Implementation

One of the major implementation difficulties with cashing-out is that it is difficult to apply to situations in which employers own and do not lease their parking. Unless an employer leases parking, it is difficult to impute a cash value to that parking. The result may be a cash-out amount that is set too low to affect SOV use or to offset administrative costs; on the other hand, it may be set so high that it is too difficult to establish.

Although in place on a limited demonstration basis in the Los Angeles region, none of the cities the research team surveyed has implemented cashing-out. However, a parking advisory committee in Portland identified current federal tax legislation as the primary impediment to cashing-out because, under a cash-out program, employees who choose the previously tax-free parking option would now be taxed on the value of the parking.

U.S. Tax Code Section 132 (f) restrictions make cash-out benefits subject to a general rule called "constructive receipt," which many feel is a major impediment to implementing current cash-out proposals (*50*). Constructive receipt imputes income to taxpayers who have a choice between taxable cash and a nontaxable benefit, *regardless of whether the taxpayer chooses the cash*. In addition, employers may not use employees' pretax income to pay for these benefits. This restriction results from the prohibition in U.S. Tax Code Section 132 (f) (4) against "in lieu compensation," which prohibits excluding benefits from gross income "unless such benefit is provided in addition to (and not in lieu of) any compensation otherwise payable to the employees."

The Tax Code also prevents cash-out benefits from being included in "cafeteria-style" benefits programs. These constraints, combined with the large differential between the $165-per-month benefit allowed for parking and $65-per-month benefit allowed for transit and vanpooling (these 1996 amounts are up from $155 for parking and $60 for transit and vanpooling in 1995), result in negligible incentives for commuters to switch from SOV commuting to another mode.

A survey of employers in the Portland metropolitan area revealed that employers are resistant to a mandatory cashing-out program; this information confirms evidence from Los Angeles, as well. The Portland survey did reveal that employers in the suburbs are interested in cashing-out as a way of foregoing the construction of new parking to accommodate increasing demand. However, these employers indicated their willingness to participate in a cash-out program only if the program were voluntary and subsidized, suggesting their reluctance to incur the administrative and other costs of a cash-out program. The Portland region's urban growth boundary keeps suburban land prices at a relative premium, thus encouraging employers to seek other ways to accommodate growing parking demands. Where such growth controls are not in place or where expansion of parking supply is not a problem, there may be little incentive for employers to participate in cashing-out, even if it is subsidized.

This strategy is expected to be moderately easier to administer. Although little new technology or institutional change would be required, employers would have to take on the task of administering the cash-out program.

[50] Filler, L., and Gerwig, K., "Commuter Choice Initiative Update." *TDM Review* (Spring 1996) pp. 15–18.

Expanding Meters and Accompanying Residential Permit Programs

Definition

This strategy would extend meters outside of the CBD to other business districts within the central city and suburbs. It would also involve instituting residential permit programs in areas surrounding the metered locations to ward off spillover parking from metered spaces on to streets in nonmetered residential zones. Residents would pay a small annual fee to purchase a sticker for their automobile, and visitors would be able to park in the zone for a limited amount of time, such as 2 hours.

Effectiveness

The research team did not quantify or model this strategy. However, the researchers expect it to result in a low to moderate effect on transit ridership, with the greatest effect being in areas with high-quality transit service. This strategy is best suited to areas experiencing problems with spillover parking (e.g., shopping, office, or university districts; hospital complexes; or other locations where off-street parking is priced or limited in supply).

Scope

In areas where spillover parking is a particular problem, on-street meters and permit programs target all-day parkers—the temporal scope is broad (peak-hour drivers are not singled out). Overall, however, the approach is aimed at employees, so the functional scope is narrower. The spatial scope of this strategy is also narrow—it is applied in specific districts and neighborhoods.

Political Feasibility

This strategy has moderate political feasibility.

Those made better off by this strategy include travelers on shopping or personal business trips, who are more likely to find on-street spaces not filled by employee parking. Neighborhood residents also benefit by not having to compete with employees for on-street spaces. Some residents, however,

may object to the annual fee, although it is usually small, and to the short period allowed for visitors. Transit interests would benefit from the modest increases in ridership, as would local officials concerned about improving access to the CBD.

Although retailers and service providers may benefit from a greater number of customers because of turnover of metered on-street spaces—and particularly higher income customers, who are more likely to pay to park—business owners tend to be the most vociferous opponents of permit and meter programs. Despite proponents' assurances that firms would not suffer financial losses and that business conditions might even improve, most businesses oppose any pricing of parking that might restrict their customers' access. Others who object to these programs are long-term parkers, particularly employees, who park in free on-street spaces; other opponents are those who continue to park and pay, even though they find the fees a financial hardship. Finally, those who oppose increasing fees and taxes or regulation by the government will also consider themselves to be made worse off.

Where parking is in high demand (e.g., in high-density activity centers), significant revenues can result with which to compensate those whom this strategy makes worse off. As noted in Chapter 5, policy-makers can use these revenues as Donald Shoup suggests, that is, to create "benefit districts," by which the city funnels revenues back into the district in the form of benefits such as improved landscaping and lighting, bicycle and pedestrian amenities, and even improved transit *(46)*.

Expanding meters and accompanying residential permit programs would make society as a whole only minimally better off, because the effects are localized and thus not likely to have a very great effect on regional SOV reduction, air pollution, and other nonmonetary negative externalities.

Economic Efficiency

Over the long term, some decentralization may occur, if on-street controls lead to a loss of business or loss of residential attractiveness. However, if these controls exist outside of the CBD and central city as well, decentralization would be minimal. There might also be displacement of spillover parking into yet additional areas (rather than an eradication of it altogether).

Overall, though, this strategy has moderate to high efficiency, depending on where officials implement it. If they implement meters and permits in high-density areas with excess demand for parking, the programs will be more efficient than if implemented in low-density locations with excess parking supply. That this strategy expressly addresses the negative externality of spillover parking also enhances its efficiency. If officials set meter and permit rates to inefficiently high (or low) levels, however, efficiency may be compromised.

Ease of Administration and Implementation

The survey of parking policy in 20 central cities revealed that parking meters are employed outside of the CBD in most, but not all, of the cities. The two cities in which parking meters are entirely confined to the CBD are Portland and Houston. In Providence, Cleveland, and Boston, between 85 and 97 percent of all meters are confined to the CBD.

In most of the cities, residential permit programs complement on-street metering outside of the CBD. However, in five of the cities where most of the meters are located *outside* of the CBD, no residential permit program is in place, suggesting that spillover problems are either not serious or remain unaddressed. On the other hand, it may be that the primary purpose of the metering program is revenue generation rather than control of parking supply or stimulation of pricing.

As with parking taxes, a program of extended parking meters and residential permits is part of an overall transportation policy in only a few cities. For example, Portland is endeavoring to tie parking policy to an overall transportation policy. As part of its Central City Transportation Management Plan (CCTMP)—a joint planning process involving the city, the regional transit agency, the state department of environmental quality, the regional planning agency, and two central city development interests—Portland has been trying to extend meters and permits into the Lloyd District.

The Lloyd District is a commercial and retail area just across the Willamette River from the CBD and home to a large shopping center, office buildings, and the city's convention and sports facilities. A district task force has proposed a package that includes parking meters for on-street parking and permit programs for nearby residential neighborhoods. Area businesses have indicated their willingness to support the package only if it also includes certain transit improvements such as extension of the city's "Fareless Square" (currently confined to the CBD) and more direct bus service. The city has approved the plan, but because of lack of political support, has not yet implemented it.

There are other districts in Portland whose plans also include recommendations for extending meter and permit zones, most notably the city's Northwest and Hawthorne districts. The political process involved with implementing these measures in all three districts—Lloyd, Northwest, and Hawthorne—is proving to be complex. In the 6 years since the inception of the CCTMP process, no additional meters or residential permit zones have been implemented. Businesses are reluctant to support extension of metering without significant—and expensive—transit improvements; meanwhile, in Portland, as in many cities, the legal process for implementing residential permit programs is very involved.

The study of parking procedures at universities and hospitals revealed that the residential permit program is an important component in isolated, localized situations. The researchers looked at two hospitals and one university in Portland. In one case—Good Samaritan Hospital in Northwest

Portland—there are no parking policies in place to control spillover parking. Employee and patient parking is not priced, and there is a serious shortage of parking for employees. Spillover parking from the hospital competes with on-street parking demand that other businesses and residences in the area generate. However, those involved with parking at the hospital do not connect hospital parking practices with transportation policy in general. The researchers also examined a second Portland institution, Portland State University. All nearby on-street parking is metered, with the longest term being 3 hours. Portland State makes some attempt to coordinate its parking program with a larger transportation policy, employing discounted transit passes and near-market parking prices. The city has implemented a residential permit zone in an area to the west of the university to cope with spillover parking. The third Portland example, Oregon Health Sciences University, offers the best illustration of a special generator relating its parking program to a larger transportation policy. The University prices on-site employee parking spaces at near-market rates, with graduated prices that increase with proximity to larger buildings; provides transit passes free of charge to all employees; cooperates with a residential permit program to control spillover parking; provides bus service to satellite parking lots; and has worked with the regional transit agency to introduce more bus lines offering direct service to the hospital campus.

The researchers also studied the case of the University of Washington, in Seattle. This city's master plan addresses some of the complexities of implementing a residential permit program. The plan requires the University of Washington to support local groups in the development and implementation of residential permit zones; the University pays for 100 percent of the setup costs, including the collection of data and studies for establishment of the zones. The University must also pay for permit costs. This obligation requires the University to pay for 100 percent of a household's first permit and 50 percent of the second permit.

These studies illustrate that there is a wide variation of parking policy with respect to meters and residential permit programs. In general, meter programs appear to be politically complex to implement, because there must be support from most area businesses, who are generally opposed to permit programs. Residential permit zones surrounding the metered areas are both legally and politically complicated to implement; not only is support from area residents and business necessary, but city codes typically require officials to conduct surveys to demonstrate that a significant number of parked vehicles do not belong to area residents and that most of the residents and businesses support the program.

The ease of administration of this strategy is low to moderate. Not only are surveys required, as mentioned above, but residential permit and on-street metering programs require monitoring and enforcement. Although fees and fines can contribute to city revenues, they require that mechanisms be in place for collection and dissemination. Some localities are investigating new meter technologies that allow the use of "debit cards" and decrease the labor necessary to collect fees.

Parking Impact Fees

Definition

Parking impact fees are a subset of road impact fees, that is, in some situations, the number of parking spaces that a new development provides may be taken as a proxy for the effect that development will have on the transportation system. Authorities would impose a one-time fee on developers, which is meant to cover the costs the parking creates for the transportation system as a whole. Impact fees might provide an incentive for developers to provide only the amount of parking actually needed.

Effectiveness

The researchers expect that the full effect of impact fees would not be apparent in the short term and is thus difficult to estimate. The effect would probably be very low in the short term and somewhat greater in the long term. In any case, impact fees would affect areas of new development only.

Scope

Impact fees would have a broad temporal scope because they would not specifically target peak-hour drivers. Their functional scope is also broad because they would not target any particular driver or trip type. Because they would be aimed specifically at parking in areas of new development, their spatial scope is fairly narrow.

Political Feasibility

The political feasibility of parking impact fees is moderate to high—"making development pay its own way" is popular among policy-makers and the public.

Those whom this strategy would make better off are those individuals in and users of already-developed areas who would benefit from increasing the cost of new development. This would include slow-growth advocates, as well as the authority collecting the revenues. Those made worse off would include owners of newly developed land, who would have to absorb the fee if they could not pass it on in the form of higher prices. Users of newly developed areas would be worse off, as well, if the developers and businesses provided too little parking or passed the impact fee on in the form of a high parking fee or higher prices for goods and services.

Although this strategy would yield revenues to the authority imposing the impact fee, in general, states may not use an impact fee for any purpose other than "to meet the service

needs directly attributable to the project bearing its cost" (*51*). In addition, impact fee revenues "must be segregated until used and must be expended in timely fashion (generally, within five or six years) for the purposes originally designated." These restrictions, known in judicial terms as "rational nexus," have been applied by the courts of most states. The implication is that there may be strict limitations on how and when the revenues from impact fees may be spent (e.g., for shared publicly provided parking). It may not be possible to divert these revenues to mechanisms such as transit improvements for compensating those negatively affected by the fees. This issue could detract from the political acceptability of parking impact fees, if that acceptability hinges on using revenues for compensatory purposes.

Societal benefits from an impact fee are likely to be modest—the effects on nonmonetary negative externalities may not be very significant, especially in the short term.

Over the long term, impact fees may stimulate more compact development in areas of new growth; compact development is a common response in areas with restricted parking supply, which, although desirable to many environmentalists and slow-growth advocates, might have the unintended consequence of increased congestion. As with many other strategies, impact fees may also engender spillover parking or require additional administrative costs or valet parking to allocate scarce parking space.

Economic Efficiency

Parking impact fees are likely to have low to moderate efficiency. Such fees are a very indirect means of influencing modal behavior. In addition, if the fees result in inadequate parking supply, they may engender spillover parking. However, insofar as existing parking supply standards might be too high, parking impact fees would stimulate a more efficient supply of parking. In other situations, it may be more efficient to provide shared parking, as discussed in the following section, using revenues from impact fees as a financing mechanism.

Ease of Administration and Implementation

Although none of the case studies offered examples of parking impact fees, existing instances of road impact fees illustrate the implementation challenges associated with parking impact fees, particularly with respect to the "rational nexus" limitations discussed above.

The ease of administration of parking impact fees is moderate. Some institutional and legal changes would probably be required for the implementation and collection of the fee. That the fee is a one-time-only charge lessens any potential administrative difficulty. A particular problem with the impact fee is that there are likely to be substantial differences in the amount of traffic generated by different developments in different locations. The only way that these differences could be accounted for would be if assessors studied each development in detail to determine its expected effect and then translated that effect into a fee per parking space. This differentiation, however, would add an administrative cost that would negate the savings gained by imposing a one-time-only fee instead of an annual tax. Ease of administration would also be significantly compromised if legislative changes were necessary to modify the rational nexus provisions that limit the use of revenues resulting from impact fees.

ASSESSMENT OF NONPRICE-BASED PARKING STRATEGIES

This section addresses three nonprice-based parking strategies:

- Changes in zoning ordinances to restrict parking supply,
- Shared parking, and
- TDM approaches (consisting of satellite parking-shuttle lots, preferential parking for carpoolers, and transit-incentive programs).

Changes in Zoning Ordinances to Restrict Parking Supply

Definition

This study evaluated three types of modifications to zoning ordinances: decreasing minimum parking requirements, imposing maximum parking requirements, and issuing conditional-use permits.

Because ordinances typically base minimum parking requirements on the amount of parking that would be required during times of peak use—during holiday shopping season, for example, at a mall—they often result in excess supply during nonpeak periods. Zoning ordinances often contain minimum parking requirements to ensure adequate parking supply and to discourage spillover parking during peak periods, but result in excess supply the rest of the time (*52,30*). Thus, one way to modify zoning ordinances is to decrease these minimums to bring them closer to typical nonpeak needs. Another approach is for zoning codes to impose parking maximums, which would cap the amount of parking developers may provide. Alternatively, municipalities may grant conditional-use

[51] Altshuler, A., and Gómez-Ibáñez, J., *Regulation for Revenue: The Political Economy of Land Use Exactions*. The Brookings Institution and the Lincoln Institute of Land Use Policy (1993), p. 52.

[52] Shaw, J. "Minimum Parking Requirements in Midwestern Zoning Ordinances." Paper presented at the Transportation Research Board 76th Annual Meeting, January 12–16, 1997, Washington, D.C., Preprint No. 97-0405.

permits allowing a developer to provide an amount of parking that is below the minimum stated in the zoning code. Frequently, in such scenarios, cities require developers to furnish support for alternative transport modes or pay money into a city "in-lieu fund" in exchange for being allowed to provide below the minimum. Cities also implement in-lieu funds when the provision of on-site off-street parking is not feasible. In these cases, the in-lieu funds are typically used to finance shared parking, usually in the form of subsidized municipal lots or structures, as well as alternative transportation modes.

Effectiveness

Effects on transit share would vary greatly according to local conditions and would differ in the intermediate and long term. These strategies are all estimated to have very low effects in the short term, which become only slightly higher in the long term.

Scope

Changes in zoning ordinances would not specifically target peak-hour drivers; hence, the temporal scope is broad. Their functional scope is also broad, because these strategies do not target specific driver or trip types. Finally, because these changes would be confined to areas of new growth, their spatial scope would be fairly narrow.

Political Feasibility

These approaches are expected to have moderate to high political feasibility.

In general, developers benefit from reduced costs associated with providing less parking. Those whom such strategies might make worse off include travelers, if the new parking supply turns out to be too low, as well as firms that might suffer business losses because of inadequate parking supply.

Of the three strategies in this category, only conditional-use permits would generate revenues and, although these might be used to support alternative transport modes, it would be difficult to identify and compensate directly any individuals or groups made worse off. Like parking impact fees, changes in zoning ordinances would affect areas of new development only. This fact restricts these strategies to the suburbs and other areas of new growth and may thus be perceived as punitive in those areas. Where they are in effect, they may stimulate slightly more compact development.

The effect on society as a whole is probably very minimal, because changes in zoning code are not likely to result in substantial improvements in nonmonetary negative externalities.

Economic Efficiency

Changes in zoning ordinances are likely to have low to moderate economic efficiency for the same reasons as parking impact fees: although the temporal scope is generally broad, existing inefficiencies because of oversupply of parking may be corrected. If the changes result in an inefficient *under*supply of parking, however, economic efficiency is not improved. That is, if either minimums or maximums end up resulting in inadequate supply, spillover may result.

Ease of Administration and Implementation

The case study of parking policy in midtown Atlanta is an example of reducing minimum parking requirements in an area with good rail transit service *(27)*. As Chapter 3 notes, buildings in the SPIDs in midtown Atlanta have no parking minimums. The research team assessed the parking ratios that have developed inside SPIDs since 1980, and when all parking facilities are included in the assessment—including surface lots not connected with buildings—the parking ratios inside the SPIDs are lower than those outside. The Atlanta case suggests, however, that a parking policy that focuses on just one element—minimums—may not guarantee that there will be changes in travel and parking behavior. By themselves, minimums—which allow flexibility in choosing the number of spaces to be provided—do not necessarily result in lower parking ratios. The relatively low ratios inside the Atlanta SPIDs may be the result of unique factors, such as the widespread availability of very low-priced parking on vacant land outside the SPIDs.

The case study of parking policy in Portland also sheds light on controlling parking through development ordinances. Portland's extensive parking policies were first formulated in the Downtown Parking and Circulation Plan of 1975. The Parking and Circulation Plan included a limit on parking supply within the CBD. The centerpiece of the plan was the 1977 completion of the transit mall in downtown Portland, with dedicated bus-only lanes along two major streets in the CBD. The downtown limit is being replaced by a program of parking maximums, to be extended throughout the entire central city. New commercial developments in the CBD are subject to maximum parking ratios ranging from 0.7 parking spaces per 1,000 square feet of floor space located along the transit mall to 1.0 spaces away from the mall. The ratios increase in areas of lower transit service. As with the case of extending meters into the Lloyd District, the parking limit and the parking maximums were strongly contested by local businesses, who, in the case of the limit, gave their approval only once they were assured of improved transit service along the transit mall. In the case of the parking maximums, businesses are insisting that maximums be tied to transit service levels. Even with such assurances, many businesses are resisting ratios that diverge from those now in place.

The midtown Atlanta and Portland case studies are instructive in suggesting that parking requirements in zoning ordinances alone are difficult to implement and may not necessarily be effective in reducing parking ratios. To be effective, minimums should be complemented by maximums. To enhance political acceptability, policy-makers need to ensure that maximums are accompanied by significant transit service improvements.

The ease of administration of these changes in zoning ordinances is moderate. Both maximums and minimums must be enforced—it is up to the municipality to monitor developments to ensure that standards are met. Where conditional-user permits are involved, the municipality is responsible for monitoring the developments to ensure that the minimum number of spaces has not been exceeded *and* that the agreed-upon alternative transportation programs are being provided. Ensuring compliance is easiest if the developer agrees to pay an in-lieu fee rather than to provide alternative transportation programs.

Shared Parking

Definition

The City of Portland's zoning regulations define shared parking as the "joint use of required parking spaces . . . where two or more uses on the same or separate sites are able to share the same parking spaces because their demands occur at different times" (*53*). Typical examples of land uses that can share parking because of different peaking characteristics are a church and an office building, a dinner restaurant and an office building, a movie theater and a shopping center, a school and a recreational event. Certain types of uses (e.g., a church or a movie theater) that peak after business hours may also be used as park-and-ride facilities. In fact, general-purpose commercial parking lots and structures in downtowns are classic examples of shared parking. What is considered here is how to replicate that concept with a policy in areas where it is desirable to limit new parking supply (such as in the suburbs or in areas of new development).

Effectiveness

Shared parking facilities would not directly affect transit ridership. Shared parking may indirectly facilitate transit because the strategy would promote denser developments, as establishments "cluster" around their shared parking facilities. The higher densities would probably benefit transit. In addition, to the extent that a third party (e.g., a parking operator) provides the shared parking and prices it at market levels, this strategy would have a low to medium effect on SOV reduction.

Scope

Shared parking has a fairly broad temporal and functional scope in that it does not target peak-hour drivers or specific types of trips and travelers. As with parking impact fees and changes in zoning ordinances, the spatial scope would be narrower.

Political Feasibility

The political feasibility of shared parking is moderate to high.

Developers and firms can benefit from shared parking because they save on monetary outlays in providing exclusive parking spaces. In some cases, firms might benefit from increased traffic as a result of the shared spaces. For example, commuters parking in a dinner restaurant lot might stop to have dinner after work before heading home. However, drivers and firms might be made worse off if shared parking supply turns out to be inadequate over the long term.

The revenues that result from shared parking come from the additional fees paid by developers; city officials use these fees to finance the review process. There are probably not enough excess revenues to be funneled into compensating the few whom this strategy might negatively affect.

Societal benefits are similar to those resulting from changes in zoning ordinances; because the effects on nonmonetary negative externalities, such as pollution, are likely to be minimal, overall societal benefits are not great. On the other hand, because shared parking means that firms have an incentive to cluster together to share parking, this strategy may facilitate compact development and fuel centralization of activities.

Economic Efficiency

Shared parking, as with parking impact fees and changes in zoning ordinances, may stimulate a more efficient supply of parking, thus enhancing economic efficiency. However, the strategy is broad in temporal and functional scope and may result in spillover parking if supply proves inadequate. If shared parking were to be provided by a third party and priced at market levels, this might mitigate inefficiencies resulting from free or below-market pricing. Thus, shared parking has a moderate efficiency rating.

Ease of Administration and Implementation

Problems associated with inadequate or costly parking supply can be mitigated by allowing firms with different

[53] City of Portland, Zoning Code, Chapter 33.266, "Parking Requirements," p. 2.

peaking characteristics to share parking, while providing enough to meet any minimum parking requirements that might be in place. However, several institutional barriers to shared parking exist within the current regulatory environment.

The Portland city code, for example, requires developers to submit the following documentation to the Bureau of Planning as part of the building permit application or land review process for shared parking:

- The names and addresses of the tenants sharing the parking;
- The location and number of parking spaces being shared;
- An analysis showing that the peak parking times of the uses occur at different times and that the parking area will be large enough for the anticipated demands of all uses; and
- A legal instrument, such as an easement or deed restriction, guaranteeing access to the parking for all uses.

Aside from the burden of paying for additional analysis, there are associated barriers. One is the land review process, which can attach conditions (such as shared parking) to a current development proposal, but cannot attach conditions to existing adjacent land uses. A recent case came before the City of Portland that illustrates this point. A community college applied for permission to develop a branch campus facility in a mixed-use, central city location. Immediately adjacent to the proposed facility is a large museum and a satellite park-and-ride lot serving employees of a large regional hospital. A new office complex is also planned in the immediate area. This is exactly the kind of location where shared parking would be ideal. The city, however, was unable to facilitate the community college's sharing of parking with any other adjacent uses, despite the strong potential for such an arrangement. The reason was that, although the city could require the college to obtain shared parking with its neighbors, it could not require those neighbors to share parking with the college because those neighbors did not have any current land use applications to which conditions could be attached.

For the reasons mentioned above, ease of administration for implementing shared parking under current conditions is rated as low to moderate.

TDM Approaches

Definition

The TDM policies that this report considers are satellite parking-shuttle lots, preferential parking for carpoolers, and transit-incentive programs. These are typically implemented by large employers or TMAs. TMAs are private enterprises, most commonly found outside of central cities, which charge employers and firms a fee to provide various transportation-related services, such as shuttles, child care, carpool matching, and bicycle amenities.

A satellite parking-shuttle lot approach would involve an employer or TMA furnishing an off-site parking lot and transportation to and from the lot to the main destination. This transportation would typically be in the form of a bus shuttle or van service, although the distance may be short enough that employees could walk. Transit might also be used for the short distance; this strategy differs, however, from the more formal park-and-ride lot typically located a great distance from the traveler's destination and operated in conjunction with the regional transit provider.

Preferential parking for carpoolers involves employers converting a fairly large number of preferentially located SOV parking spaces to preferentially priced carpool spaces.

Transit incentive programs are implemented by major employers and are typically part of a larger transportation policy—either at the institution or within the region. For example, an employer might stimulate transit use by subsidizing transit passes in part or in full for employees and by giving transit commuters a "parking allowance," enabling them to park free for a few days per month. The employer also might want to make vehicles available for employees to use in case of an emergency; this sort of program is known as Emergency Ride Home (ERH) or Guaranteed Ride Home (GRH).

These TDM approaches are included in this research because of their merit as parking strategies and because such alternatives are necessary for compensating those whom pricing approaches might make worse off. In other words, travelers priced away from SOV use will need a viable alternative and a TDM approach, such as transit incentives, can provide that.

Effectiveness

Of the three TDM strategies, satellite parking-shuttle lots would probably have the lowest effect on SOV and transit share, because they would not encourage mode shift. Satellite parking-shuttle lots are more of a mechanism for managing on-site parking supply and demand. Preferential parking for carpoolers is likely to have a low to moderate effect on SOV use, depending on how high the price for SOV spaces becomes. It is not likely to have any positive effect on transit share, however, because there is no incentive for travelers to choose transit over carpooling under this strategy. Transit-incentive programs are likely to have a somewhat higher effect on reducing SOV share *and* on increasing transit share. A combination of all three approaches may result in a moderate mode shift overall, although this shift is likely to be confined to the origin and destination of those commuting to the institutions where the strategies are implemented.

Scope

These three strategies are all aimed at peak-hour travelers. Thus, their temporal and functional scopes are narrow.

Because these strategies would be applied in specific geographic locations, their spatial scope is narrow as well.

Political Feasibility

The overall political feasibility of TDM strategies is high.

A primary beneficiary from satellite parking-shuttle programs is the establishment or employer that cannot afford to add more parking spaces on site. Neighborhood residents would also benefit if the satellite lot provided a suitable alternative to spillover employee parking on residential streets. The decrease in SOV varies according to location and circumstances and can range from negligible to moderate. Thus, other beneficiaries would be those travelers who would benefit from small to moderate decreases in travel and parking congestion. Those negatively affected would include users of the satellite facility, if they considered on-site parking to be more convenient. If the cost of providing the facilities is more than the cost of expanding on-site parking, this strategy might negatively affect employers.

Those who would be made better off by a strategy of preferential parking for carpoolers include those who already commute by carpool and SOV or transit commuters who are willing to convert to carpool commuting. All peak-hour commuters would also benefit from a moderate decrease in congestion. Those made worse off, on the other hand, would include those SOV commuters who are unwilling or unable to convert to carpool commuting and unwilling or unable to pay the premium prices for SOV spaces.

Beneficiaries from a transit-incentive program would include existing transit riders, but, because of the moderate reductions in SOV travel that can result from such a strategy, all peak-hour commuters would benefit from some decrease in congestion. On the other hand, the parking allowance element of this strategy—which allows transit users to park on occasion—can result in a shortage of parking, thus negatively affecting all drivers to the location. Interest groups, such as low-tax advocates, who are opposed to increasing transit subsidies, may consider themselves worse off, because this program typically depends on an increase in transit subsidy, frequently through an increase in taxes or other fees.

The only one of these strategies capable of generating excess revenues is preferential parking for carpoolers, which would involve increasing the price of SOV parking. It may be possible to use some of these revenues to compensate those made worse off by the strategy, such as low-income drivers who are unable to carpool.

Economic Efficiency

These strategies are fairly targeted in scope in the locations where they are implemented—they are directed toward the peak-hour commuter. This contributes to economic efficiency, although the overall percentage of all commuters affected may not be very great. Long-term effects on urban structure, if any, are minimal. Short-term problems, such as spillover parking, may result, but not to the extent expected by some of the other strategies. Thus, these strategies have moderate to high efficiency.

Ease of Administration and Implementation

There are several examples of situations in which institutions or other entities employ TDM strategies that include parking programs such as satellite parking and preferential parking for carpoolers. The case study of parking policy in Portland illustrates the use of long-term on-street parking meters reserved for carpoolers during business hours. In an effort to decrease the number of SOV parking spaces throughout the region, Portland may, in fact, increase the number of such carpool spaces, because these are not included in the overall inventory of parking spaces. Programs geared toward preferential parking for carpoolers do not positively affect transit share.

The study of parking policy in edge cities also provides examples of TDM. To meet growing transportation needs or state mandates, an increasing number of TMAs are forming in edge cities and other noncentral locations. A good example is Warner Center, in the Los Angeles region.

Warner Center includes about 15 million square feet of development, mostly retail and office, with about 40,000 employees. It is subject to both the City of Los Angeles's specific plan governing Warner Center's land use planning, zoning, and development, and to Regulation XV, Southern California's Employee Commute Option program. Its TMA is the Warner Center Transportation Management Organization (TMO), which was created in 1989 and for which private entities such as the Voight Companies, one of Warner Center's principal developers, provide the primary source of funding.

The Warner Center TMO provides various services, including a midday shuttle, child care, computerized carpool matching, vanpool incentives, transit and rail pass distribution, commuter shuttles, a GRH program, and a bicycle club. Parking maximums set a cap on parking supply, although supply is still adequate enough to allow for free parking for 40 of the 45 largest employers. Despite the nearly ubiquitous free parking, SOV commuting within Warner Center has fallen from a high of 85 percent in 1987 to a low of 70 percent in 1994; this decline may be attributed in large part to the TDM programs.

Another example of TDM is that found at universities, as revealed by the study of parking procedures at universities and hospitals. The University of Washington, for example, implemented a transportation management program in 1991 to serve its 50,000 employees and students. The central fea-

ture of the program is the U-PASS, a highly discounted transit pass offered to those holding university identification cards. The program involves increased transit service, shuttle service, free carpool parking for holders of the U-PASS, vanpools, ridematching, bicycle amenities, and reimbursed ride home for transit riders.

Before the program's inception at the University of Washington, transit share was 21 percent, carpooling 10 percent, and SOV 33 percent. Walking, bicycling, and other modes made up the remaining 36 percent. With the program in place, transit share has risen to 33 percent and carpooling to 11 percent, while SOV has dropped to 23 percent. The remaining modes are capturing 33 percent. There are a few problems associated with the program, however. In order to take advantage of carpool parking, some people are forming carpools just off campus. Revenues from parking have been somewhat decreased because of the conversion of SOV spaces to free carpool spaces. Spillover into neighborhoods has necessitated a costly residential permit program, which the university supports at a cost of more than $25,000 per year. The university also incurs large costs in subsidizing the reduced-rate transit pass.

A final example of TDM is the "group transit pass" program negotiated by the Lane Transit District (LTD) in Eugene, Oregon, and large special-generator sites, such as the University of Oregon (UO). The LTD's group pass program is based on the concept that both transit and nontransit users benefit from increased transit service and ridership and that they should therefore share in the cost of service enhancements. By spreading the cost among riders and nonriders alike, the per-person transit price is dramatically reduced.

As structured at UO, the group pass program increases student fees for *all* students, providing a free transit pass to any student who wants one. Since 1988, the UO student body has approved increases in student fees to support the group pass program. For the 1994–95 academic year, the fee increase was $6.20 per term, or a little over $2 a month. With this fee increase, students receive a sticker they affix to their student ID, which allows them unlimited free bus service throughout the LTD system.

The student body vote to increase the student fees has passed by only a very small margin every year since 1988. There continues to be a group of students who oppose the fee increase, on the grounds that they do not use transit and, therefore, do not think their fees should be increased to support it. Although the very principle behind the group pass program is for both riders and nonriders to share in the cost, the LTD decided to implement a refund program for those students who are not bus riders. While the level of refunds has been only 1 or 2 percent of all UO students per term, the LTD has not included a refund mechanism with subsequent group pass employers, such as Sacred Heart Medical Center, Northwest Christian College, and the City of Eugene.

Despite the complexities of providing a refund for a small percentage of students at UO, the group pass program has proved very successful. Since 1988, daily transit ridership has increased from 1,398 to 4,171 in 1994—an increase of nearly 200 percent. Enrollment has actually decreased during the same period by 4 percent, making the increase in transit ridership all the more dramatic.

The free transit pass is not the only component of the group pass program at UO. LTD has added new routes and additional trips along existing heavily used transit routes. It also added a major transit station for the UO area. Both LTD and UO recognized that a program meant to increase transit ridership would need to be complemented with significant increases in transit service.

The ease of administration for TDM strategies varies. Satellite parking-shuttle lots are very expensive to implement. Employers or independent operators typically lease the facilities, and the cost of leasing is highest for facilities in or near the CBD. These facilities also work best if shuttle service is both very frequent and fairly fast and if operators provide security at the lots. Operators will have to sustain large deficits, rely on generous subsidies, or pass some or all of the cost on to the commuters. If an employer is operating the shuttle, insurance costs must be added to the operating expenses. Employers might also want to bar junior employees from on-site spots and require them to use the remote lots. Such differentiation incurs additional administrative costs in implementation and monitoring. The employer's losses in operating such a facility are offset only insofar as the costs of providing additional on-site parking would be higher. The ease of administration of this strategy is low.

Preferential parking for carpoolers has a moderate ease of administration. For preferential parking to be effective in diverting meaningful numbers of drivers to transit or carpool, the carpool spaces have to be significantly better in terms of location, security, price, and other amenities (e.g., located in a covered structure) than the remaining SOV spaces, which drivers must therefore consider to be highly undesirable in comparison.

Transit incentives also offer moderate ease of administration. Employers need to identify a means for distributing free or discounted transit passes. If a refund mechanism is included, as in the case of the University of Oregon, administration becomes very complex. Employers also need to determine how to manage any parking allowance they might choose to provide for transit riders. The problem with offering occasional free parking is that, on any given day, there may be an unpredictably large demand for free spaces, thus creating a shortage for those who have paid for their spaces. One alternative is to limit the free spaces to one certain location, so that paying parkers are not competing with free parkers. However, the employer will still need to calculate how many spaces should be set aside for free transit commuters or come up with alternate compensation if the free spaces are full.

CHAPTER SUMMARY AND CONCLUSIONS

Table 22 summarizes the assessment of the strategies discussed in this chapter. With the exception of the increase in

TABLE 22 Assessment of individual parking strategies (see tables 16–20 for explanation of ratings)

Strategy	Effectiveness	Scope	Political feasibility	Efficiency	Ease of administration
Increasing the price of parking, based on a tax on revenues	Moderate	*temporal*: broad *functional*: moderate-narrow *spatial*: moderate-narrow	Moderate	Low to moderate	Moderate to high
Increasing the price of parking, based on a tax on parking spaces	High in cbd with good transit service; lower in suburban business districts or where transit service is low	*temporal*: broad *functional*: broad *spatial*: broad	Low	Low	Low
Cashing-out employer provided parking	Moderate	*temporal*: narrow *functional*: narrow *spatial*: narrow	Moderate	Moderate	Moderate
Expanding meters and accompanying residential permit programs	Low to moderate	*temporal*: broad *functional*: moderate-narrow *spatial*: narrow	Moderate	Moderate to high	Low to moderate
Parking impact fees	Very low in short term; somewhat greater in long term	*temporal*: broad *functional*: broad *spatial*: narrow	Moderate to high	Low to moderate	Moderate
Changes in zoning ordinances to restrict parking supply: • **Decreased minimums** • **Parking maximums** • **Conditional-use permits**	Very low in short term; somewhat greater in long term	*temporal*: broad *functional*: broad *spatial*: narrow	Moderate to high	Low to moderate	Moderate
Shared parking	Low	*temporal*: broad *functional*: broad *spatial*: narrow	Moderate to high	Moderate	Low to moderate
Satellite parking-shuttle lots	Low	*temporal*: narrow *functional*: narrow *spatial*: narrow	High	Moderate to high, unless high subsidies required	Low
Preferential parking for carpoolers	Low to moderate	*temporal*: narrow *functional*: narrow *spatial*: narrow	High	Moderate to high, unless high subsidies required	Moderate
Transit-incentive programs	Moderate	*temporal*: narrow *functional*: narrow *spatial*: narrow	High	Moderate to high, unless high subsidies required	Moderate

the price of parking, based on spaces, all of the parking strategies considered here have a moderate to high degree of political feasibility. Most also are moderately easy to implement. Only those that are employer-specific, such as cashing-out and the TDM strategies, are well targeted to peak-hour travelers.

Overall, the best strategies in terms of political feasibility are more narrow in scope, such as expanding meters and residential permit programs, as well as TDM approaches such as satellite parking-shuttle lots. Some of the broader strategies are more effective in terms of increasing transit ridership, but at the cost of potentially severe difficulties, such as inequities or administrative obstacles. Thus, the strategy with the highest level of effectiveness in changing mode share—increasing the price of parking, based on a tax on spaces—is also the least politically feasible.

No single strategy is both effective and politically feasible enough to have a substantial effect on SOV and transit share. Therefore, a combination of programs targeted to specific localities may be the best approach both in terms of acceptability and effectiveness. Chapter 7 discusses the combination, or "package," approach to parking policy.

CHAPTER 7

IMPLEMENTATION GUIDE

INTRODUCTION

This study has looked at the extent to which parking strategies might be used to increase transit ridership. The assessment of individual strategies in the previous chapter indicates that no single strategy—such as a cash-out program or increasing the price of on-street parking through a tax on spaces—is both effective enough and politically feasible enough to warrant implementation in isolation. Broad strategies, such as a uniform regionwide parking tax may appear to be the most equitable solution to transportation inefficiencies, but their differential effects across geographic areas and income groups—as well as their implementation and administrative difficulties—make them undesirable in most situations. Therefore, various strategies should be implemented in combinations. These combinations should include several crucial elements:

- Combinations should take a "package" approach so that revenue-producing strategies can be included to finance compensatory mechanisms for enhancing the political feasibility of the strategies.
- Transit improvements should be an important component of each package, to provide a necessary alternative for drivers whom parking strategies divert from auto travel.
- Each combination should be targeted toward a specific geographic area that has a specific parking problem or set of problems; this is because a combination of strategies targeted toward the CBD, for example, is not necessarily appropriate for an area of new growth in the suburbs.
- Just as no single strategy is universally effective, neither is any particular package of strategies in combination universally appropriate; thus, various combinations should be implemented as appropriate throughout a region.
- Groups of combination packages should work to offset spillover parking, strong decentralizing trends, or other unintended negative consequences from individual strategies or other combinations.

This chapter provides policy-makers with a quick, easy way to assess their parking policy needs, select the best combination of parking strategies for their situation, understand some of the advantages and disadvantages of each combination, and identify potential remedies to some of the implementation difficulties.

The policy contexts and strategy combinations discussed in this chapter are generic—circumstances and effects can vary markedly from one metropolitan location to another; therefore, policy-makers will probably need to adapt the following discussions to suit their particular situations.

Combinations of strategies are presented as "packages" because of the strength of the "package approach" in transportation policy in general and parking policy in particular. The package approach emphasizes three elements: (1) revenue generation so that policy-makers can implement mechanisms to compensate those whom parking strategies might make worse off; (2) improvements in the public transportation system to provide an adequate travel alternative for those drivers whom the parking strategies divert from auto travel (such improvements may be financed by revenue generated from other policies); and (3) coordination of complementary strategies throughout a region to guard against unintended negative consequences, such as spillover and decentralization.

Six combination packages are discussed in this chapter:

- Parking market combination,
- Cashing-out combination,
- Special generator combination,
- New growth combination,
- Commercial district combination, and
- Residential district combination.

Each combination is targeted toward a specific problem. The "new growth combination," for example, is targeted to developing areas, such as edge cities. The purpose of such a context-specific approach is to allow policy-makers to select a combination of strategies that is the most appropriate for a given situation. This approach recognizes that, just as there are variations across the urban and suburban landscape, there are variations in transportation problems and needs, which a dynamic policy approach that recognizes differences from one context to another is best able to address.

HOW TO USE THIS CHAPTER

The Decision Form

As a first step, policy-makers should identify the geographical area(s) of concern, for example, the CBD or a central city activity center. For *each* area identified, use the ratings 1 through 5, as shown on the scale below, to rate the conditions listed in *each* parking combination. Add up the ratings in each combination category. An example of using this form follows in the next section.

1	2	3	4	5	0 = Not Applicable
completely untrue	mostly untrue	somewhat true	mostly true	completely true	

Parking Market

- ☐ Peak-hour travel is highly congested.
- ☐ Many commuters perceive rush-hour traffic to be a problem.
- ☐ The demand for parking is high, but supply in the immediate area is limited.
- ☐ Most available parking is already priced.
- ☐ Most parking is provided by commercial operators.
- ☐ Existing transit service is fairly high.

—

- ☐ Total

Cashing Out

- ☐ For employee parking, a high degree of parking is provided free of charge by employers.
- ☐ Most employers who provide free parking for their employees lease the parking rather than own it.
- ☐ A large percentage of the employees earn relatively low wages.
- ☐ Demand for parking is high, but supply in the immediate area is limited.
- ☐ The cost of providing more parking places is very high.
- ☐ Existing transit service is fairly high.

—

- ☐ Total

Special Generator

- ☐ The site is a single high-density-employment firm.
- ☐ The site is near a residential area, where spillover parking by employees and customers/clients is a problem.
- ☐ The demand for *on-site* parking is high, but supply is limited.
- ☐ A large percentage of the employees in the area earn relatively low wages.
- ☐ The cost of providing more parking places is very high.
- ☐ Existing transit service is fairly high.

—

- ☐ Total

New Growth

- ☐ The area of concern is a suburban activity center, edge city, or other noncentral area of new development.
- ☐ Existing transit service is relatively poor.
- ☐ Decreasing single-occupancy vehicle (SOV) use is more important than increasing transit ridership.
- ☐ Congestion in and around the area is more of a problem than is a shortage of parking.
- ☐ There are some newly developing businesses close to one another that have different peaking characteristics (e.g., a dinner restaurant next to a daycare center).
- ☐ A transportation management association (TMA) is either in place or conditions are right for one to be put in place.

—

- ☐ Total

Commercial District

- ☐ The area is primarily commercial, although next to nearby high-density residential neighborhoods.
- ☐ The area is redeveloping, densifying, or expanding.
- ☐ The area has a shortage of parking that creates employee and customer/client spillover parking into nearby residential neighborhoods, with inadequate off-street parking.
- ☐ There are portions of the area that could benefit from improvements in the transportation system or general infrastructure (e.g., sidewalk repair, improvements in street lighting, bus shelters).
- ☐ There are some businesses close to one another that have different peaking characteristics (e.g., a dinner restaurant next to a bank).
- ☐ Existing transit service is fairly high.

—

- ☐ Total

Residential District

- ☐ The area is a high-density residential area.
- ☐ The area is next to a commercial district or an activity center (such as a high-density employer).

TABLE 23 Combination total ratings and policy implications

Total Rating Score	Policy Implication
25-30	Combination is likely to be very appropriate
19-24	Combination may be moderately appropriate
13-18	Combination may be somewhat appropriate
7-12	Combination may be somewhat inappropriate
1-6	Combination is likely to be very inappropriate

- ☐ Both on-street and off-street parking is frequently filled by commuting employees, clients, and customers, with little remaining for residents and residential visitors.
- ☐ There are portions of the area that could benefit from improvements in the transportation system or general infrastructure (e.g., sidewalk repair, improvements in street lighting, landscaping).
- ☐ Restricting the amount of parking used by nonresidents is more important than increasing transit ridership or decreasing SOV use.
- ☐ A significant percentage of residents (and business owners) in the area agree that parking supply is inadequate.

- ☐ Total

Table 23 suggests how policy-makers might interpret the total scores for particular combinations. A combination with a total rating score of 25 to 30 is likely to be very appropriate for a problem area under consideration. On the other hand, a combination with a total rating score between 1 and 6 is likely to be very inappropriate for the area.

A Decision-Making Example

There is an area in Portland, Oregon—one of the case studies the researchers conducted for this project—roughly 2 miles northwest of the CBD. This area, called the Northwest District, consists of two main streets of heavy commercial activity (21st and 23rd Avenues). Some of the commercial activity extends down side streets, but these consist mostly of high-density multifamily housing, much of which is gentrified older apartment stock. The farther northwest one gets from the primary commercial hub of the district, the more likely one is to find single-family houses with private garages and increasing amounts of available off- and on-street parking.

Along and near the commercial streets, however, the demand for parking far outweighs supply. There is one small priced parking lot, no parking structures, and no on-street meters. Most parking, insofar as it can be found, is free. Two major bus routes run through the district, one along each of the two main commercial streets. Their frequencies are among the greatest of all routes in the city.

There is, in addition, one large hospital located on several blocks between the two streets *(47)*. This hospital and adjoining doctors' offices have three parking structures for patients, visitors, physicians, and medical staff. Patients can park for free in any patient-designated space. Physicians can park for free in any physician-designated space, but they must have a physician decal on their cars. The decals are provided free of charge only to physicians who practice with the hospital; decals are not provided to physicians not associated with this particular hospital. Similarly, medical staff are provided with free staff decals. Staff can park only in unmarked spaces (physicians, visitors, and patients may also park in the unmarked spaces); there are no spaces designated specifically for staff. Interviews conducted for this research revealed that parking spaces in which staff may park are filled by 8 a.m. and after that time, staff must park up to six blocks away from the hospital, on adjacent residential streets. There is one large satellite lot approximately five blocks from the hospital, under a freeway overpass in a low-rent/light-industrial district. Physicians and staff with decals may park in this lot, which has a free shuttle to the hospital every 15 minutes. However, the lot remains mostly empty—both physicians and staff members report concerns about safety because of the location of the satellite lot.

The shortage of parking in the Northwest District has become a highly contentious issue since at least 1990. A 1994 survey of businesses and residents determined parking and transportation concerns to be the No. 1 problem in the area *(54)*. The parking problem in the district has been receiving regular media coverage for the past several years. Business groups and neighborhood residents have been struggling together and with city officials to solve the problems of severe parking shortages and spillover employee and customer parking into residential areas. There has been no consensus—businesses adamantly oppose restrictions on parking along or near the commercial streets, while residents are concerned on the one hand about the lack of parking space for their own vehicles and those of their visitors and, on the other hand, about the complex process involved with implementing a residential parking permit system.

[54] Bianco, M.J., Davis, J.S., Lovell, V., "Neighborhood Livability in Northwest Portland: A Case Study of Portland's Northwest District." Center for Urban Studies, Portland State University, PR081 (1994).

A policy-maker seeking a solution for the commercial streets within this district might fill out the decision form as follows:

Parking Market

[3] Peak-hour travel is highly congested.

[4] Many commuters perceive rush-hour traffic to be a problem.

[4] The demand for parking is high, but supply in the immediate area is limited.

[2] Most available parking is already priced.

[1] Most parking is provided by commercial operators.

[5] Existing transit service is fairly high.

[19] Total

Cashing Out

[2] For employee parking, a high degree of parking is provided free of charge by employers.

[2] Most employers who provide free parking for their employees lease the parking rather than own it.

[4] A large percentage of the employees in the area earn relatively low wages.

[4] Demand for parking is high, but supply in the immediate area is limited.

[5] The cost of providing more parking places is very high.

[5] Existing transit service is fairly high.

[22] Total

Special Generator

[1] The site is a single high-density-employment firm.

[5] The site is near a residential area where spillover parking by employees and customers/clients is a problem.

[2] The demand for *on-site* parking is high, but supply is limited.

[4] A large percentage of the employees earn relatively low wages.

[5] The cost of providing more parking places is very high.

[5] Existing transit service is fairly high.

[22] Total

New Growth

[1] The area of concern is a suburban activity center, edge city, or other noncentral area of new development.

[1] Existing transit service is relatively poor.

[1] Decreasing single-occupancy vehicle (SOV) use is more important than increasing transit ridership.

[1] Congestion in and around the area is more of a problem than is a shortage of parking.

[3] There are some newly developing businesses close to one another that have different peaking characteristics (e.g., a dinner restaurant next to a daycare center).

[1] A transportation management association (TMA) is either in place or conditions are right for one to be put in place.

[8] Total

Commercial District

[5] The area is primarily commercial, although next to nearby high-density residential neighborhoods.

[4] The area is redeveloping, densifying, or expanding.

[5] The area has a shortage of parking that creates employee and customer/client spillover parking into nearby residential neighborhoods, with inadequate off-street parking.

[5] There are portions of the area that could benefit from improvements in the transportation system or general infrastructure (e.g., sidewalk repair, improvements in street lighting, bus shelters).

[3] There are some businesses close to one another that have different peaking characteristics (e.g., a dinner restaurant next to a bank).

[5] Existing transit service is fairly high.

[27] Total

Residential District

[4] The area is a high-density residential area.

[5] The area is next to a commercial district or an activity center (such as a high-density employer).

[5] Both on-street and off-street parking is frequently filled by commuting employees, clients, and customers, with little remaining for residents and residential visitors.

[5] There are portions of the area that could benefit from improvements in the transportation system or general infrastructure (e.g., sidewalk repair, improvements in street lighting, landscaping).

[3] Restricting the amount of parking used by nonresidents is more important than increasing transit ridership or decreasing SOV use.

[1] A significant percentage of residents (and business owners) in the area agree that parking supply is inadequate.

[23] Total

According to the manner in which this form is filled out and using Table 23 as a guide to interpretation, it appears that while the Parking Market, Cashing-Out, and Residential District combination strategies all *may* be appropriate, the one likely to be the *most* appropriate in this situation is the Commercial District combination strategy, which has a total rating score of 27. The next section describes and discusses this combination of strategies, as well as the other five combinations of strategies.

THE COMBINATION STRATEGIES

Many of the combination strategies share a common set of parking strategies. The key is not only the content of the combination of strategies, but the *context*, that is, the specific geographical area and parking problem to which a combination strategy is applied. Thus, the Commercial District combination and the Residential District combination strategies are similar with respect to their constituent strategies, but each applies to a different situation, and policy-makers may want to apply the strategies in a different manner and with a different emphasis in one than in the other.

Each of the combinations consists of strategies with one or more of the following characteristics, as discussed and defined in the previous chapter:

- A moderate degree of effectiveness in terms of increasing transit ridership (and decreasing SOV use),
- A moderate to high degree of political feasibility,
- Potential for realizing revenues with which to compensate losers, and
- A moderate to high degree of ease of administration.

In addition, the researchers have identified compensatory mechanisms, particularly improvements in transit service, and complementary strategies that serve to make the combinations more politically feasible and to offset unexpected, negative consequences such as spillover parking, which may compromise efficiency.

The Parking Market Combination Strategy

The goal of this strategy is to encourage explicit parking pricing at market levels and thereby stimulate transit ridership. This combination is appropriate for contexts in which peak-hour travel and parking congestion is a major problem and where there is a serious shortage of parking supply. One assumption behind this combination is that, because of short supply, much of the parking in the area is already priced and, in addition, that it is provided by third-party private operators. Another assumption behind this combination is that existing transit service is already high; even if it is, however, improvements are likely to be necessary in order to accommodate those drivers diverted from SOV as the result of the strategies in this combination.

If implemented in isolation, not all of the strategies in this combination would have either a very high degree of political acceptability or a very high degree of effectiveness. However, given that an increase in parking price is estimated to have a fairly significant effect on transit ridership, this package is definitely worth considering, particularly when political feasibility may be greatly enhanced by using the resulting revenues to compensate those who might be made worse off by pricing. Again, this compensation should involve major improvements in the transit system, which will be a practical necessity because of the large number of diverted drivers. Principal strategies in this package consist of those listed in Table 24.

Increasing the price of off-street parking is the primary component of this combination. That increase may be effected by one or more of several means, although increasing the price

TABLE 24 The parking market combination strategy: assessment of individual components

Individual Strategy	Effectiveness	Political Feasibility	Potential for Realizing Revenues	Ease of Administration
Increasing the price of parking through tax on revenues	Moderate	Moderate	High	Moderate to high
Cashing-out employer-provided parking	Moderate	Moderate	Null*	Moderate
Expanding meters and accompanying residential permit programs	Low to moderate	Moderate	High	Low to moderate

*cashing-out is designed to be revenue-neutral

by taxing parking revenues is the easiest to implement and administer and also has both moderate effectiveness and political feasibility.

Parking pricing through tax increases would generate revenues, which could be used to

- Enhance transit service;
- Finance TDM programs;
- Subsidize a cash-out program for employers who lease parking;
- Reduce other transportation fees and taxes, and
- Implement infrastructure and transportation system improvements, including financing of TDM programs.

Because a relatively large number of drivers are expected to be diverted to public transit, it is essential that improvements be made in transit service to accommodate these shifts. However, these improvements must be in line with reasonable ridership estimates; otherwise, some segments of the population may oppose the amount of transit subsidy. Residential permit programs must be in place to regulate any spillover parking. Table 25 identifies some of the potential problems and proposed solutions associated with the Parking Market combination strategy.

The Cashing-Out Combination Strategy

The primary purpose of this strategy is to encourage transit ridership during peak hours through a mixture of parking and other strategies. This set of strategies targets peak-hour parkers, particularly those whose employers provide them with free parking. One assumption behind this combination is that this employer-provided parking is leased, which implies that it is primarily CBD parking (property owners in the suburbs and other low-density locations are generally able to own their parking supply, because of much larger amounts of available, affordable land). As with the Parking Market combination strategy, cashing-out is appropriate in situations where the demand for parking is high and supply is limited. It also finds support in areas where the cost of providing more parking is very high. In addition, it works best where most of the employees are low-wage earners, because these are the people most likely to be attracted to the cash-out option. The parking strategies that make up this combination are listed in Table 26.

Cashing-out does not yield any revenues with which to implement compensatory mechanisms such as enhanced transit service. However, this particular combination should be complemented by expansion of on-street meters, which *can* result in significant revenues (see Table 27). These might be used to offset some of the cost of cashing-out (if any) and to enhance transit service. This combination would require transit improvements to accommodate diverted commuters, but those improvements would not be subsidized through revenues realized from strategies in this combination; instead, the subsidy may come from other sources and involve efficiency improvements elsewhere in the transit system. Table 27 summarizes some of the potential problems and solutions associated with this combination.

The Special Generator Combination Strategy

The purpose of this strategy is to address parking problems at special generator sites and to encourage transit ridership by employees and users of those sites. A special generator is a site—such as a hospital, university, or airport—that employs

TABLE 25 The parking market combination strategy: potential problems and solutions

Political Feasibility Issues and Unintended Negative Consequences	Possible Solutions
Decentralizing effects due to higher parking prices in central city than in suburbs	Implement new growth combination in low-density areas of new development
Differential effect on low-income drivers and others negatively affected by this combination	Compensation through revenues used to • Enhance transit service • Reduce other transportation fees and taxes • Finance transportation demand management programs • Subsidize cashing-out • Finance improvements in the transportation system and infrastructure
Spillover parking	Expansion of meters and residential permit programs (already part of this combination)

TABLE 26 The cashing-out combination strategy: assessment of individual components

Individual Strategy	Effectiveness	Political Feasibility	Potential for Realizing Revenues	Ease of Administration
Cashing-out employer-provided parking (primarily leased parking, in the CBD)	Moderate	Moderate	Null*	Moderate
Transportation demand management	Low to moderate	High	Low	Low to moderate
Shared parking	Low	Moderate to high	Low	Low to moderate

*cashing-out is designed to be revenue-neutral

many people and attracts a very large clientele (e.g., students, patients, and travelers), who come and go at all times of the day and night (as well as during the morning and evening peaks). Such sites are frequently in areas where the supply of parking is far below the demand.

This combination is appropriate for several situations: where demand for parking is high, but *on-site* supply is limited; at high-density employment centers, especially those with a large percentage of low-income workers; where the cost of providing more parking is very high, and where spillover parking into adjacent residential neighborhoods is a major problem.

Because many special generators face difficult conditions of increasing demand for parking and very limited on-site supply, a growing number are beginning to regulate the supply or increase the price of their on-site parking through internal procedures, because the cost of adding new parking is so high. In this situation, there is no need to rely on a tax to stimulate pricing. The strategies that would constitute this combination are listed in Table 28.

Because internal revenues are generated by the parking pricing employed by special generators, they may use these revenues to subsidize the financing of certain compensatory mechanisms, particularly cashing-out, enhanced transit service, and TDM programs. Because the revenues are internally generated, their ability to be used for improving the transportation system in general or reducing other taxes is limited or nonexistent. Table 29 lists the various problems and potential solutions associated with this combination.

TABLE 27 The cashing-out combination strategy: potential problems and solutions

Political Feasibility Issues and Unintended Negative Consequences	Possible Solutions
Differential effect on those employers (and their employees) who do not lease parking and therefore may have little incentive to participate in cashing-out	Encourage more private third-party supply of parking, with a leaseback arrangement for the employer
Decentralizing effects due to higher parking prices in central city than in suburbs	Implement new growth combination in low-density areas of new development
Differential effect on low-income drivers and others negatively affected by this combination	Compensation through revenues from meters, used to • Enhance transit service • Finance transportation demand management programs • Subsidize cashing-out
Spillover parking	Implement expansion of meters and residential permit programs

TABLE 28 The special generator combination strategy: assessment of individual components

Individual Strategy	Effectiveness	Political Feasibility	Potential for Realizing Revenues	Ease of Administration
Increasing the price of parking through internal measures and market forces	Moderate	Moderate	High	Moderate to high
Cashing-out employer-provided parking	Moderate	Moderate	Null*	Moderate
TDM	Low to moderate	High	Low	Low to moderate

*cashing-out is designed to be revenue-neutral

The New Growth Combination Strategy

This set of strategies is targeted at addressing parking issues in areas of new development, suburban activity centers, edge cities, and other growing areas. Most of these developments are occurring in areas that traditionally have ample free parking and high levels of SOV use. Although transit service tends to be relatively poor in these areas, there is an increasing attempt in these new developments toward decreasing SOV use to reduce congestion and air pollution. In larger metropolitan areas, this trend is part of state or regional legislation requiring a metropolitanwide reduction in SOV and parking use. To achieve SOV reductions, several such areas have instituted TMAs to coordinate carpooling, park-and-ride, shuttles, and so on. Another assumption underlying this set of strategies is that some of the newly developing businesses that are close to one another have different peaking characteristics (e.g., a daycare center and a restaurant) that would allow them to share parking facilities.

This combination strategy may also serve to equalize parking treatment throughout a region and slow down some of the decentralization tendencies of other strategies. Revenues would be generated with which to fund improvements in the transportation system, including enhancement of public transit in the suburbs. This combination thus has four goals: to limit parking supply, to introduce pricing of parking, to reduce SOV use, and to equalize effects from pricing in areas of higher density. Strategies that constitute this combination are listed in Table 30.

None of the strategies except the installation of meters in activity centers is likely to have much discernible effect on modal shares in the short term. In the long term, the effect may be greater, although still probably low overall. Until densities in areas of new growth increase, parking supply is likely to remain ample and the potential for pricing low, even if the four strategies above are implemented. Policy-makers would implement a combination such as this to reduce SOV travel in low-density areas and to provide a counterbalance to the more restrictive strategies that may be implemented in high-density locations. Some of the problems and potential solutions associated with this combination are identified in Table 31.

TABLE 29 The special generator combination strategy: potential problems and solutions

Political Feasibility Issues and Unintended Negative Consequences	Possible Solutions
Differential effect on low-income drivers and others negatively affected by this combination	Compensation through revenues from internal pricing, used to • Enhance transit service • Finance transportation demand management programs • Subsidize cashing-out
Spillover parking	Implement expansion of meters and residential permit programs

TABLE 30 The new growth combination strategy: assessment of individual components

Individual Strategy	Effectiveness	Political Feasibility	Potential for Realizing Revenues	Ease of Administration
Changes in zoning ordinances to restrict parking supply	Low	Moderate to high	Low to moderate*	Moderate
Shared parking	Low	Moderate to high	Low	Low to moderate
Parking impact fees	Low	Moderate to high	Moderate	Moderate
Expansion of meters in activity centers	Low to moderate	Moderate	High	Low to moderate

*Of the three types of changes—decreased parking minimums, parking maximums, and conditional-use permits—the latter, particularly in the form of in-lieu fees, is the most likely to generate revenues.

The Commercial District Combination Strategy

This strategy is aimed at business districts that expand beyond the traditional CBD and into peripheral areas, where parking supply is limited. The goal of this strategy is to introduce pricing into the area and to encourage transit ridership. The Commercial District combination strategy is applicable in commercial districts next to residential neighborhoods, where a shortage of employee and customer parking has resulted in spillover parking onto residential streets. An underlying assumption is that the area is vital and growing or redeveloping to a degree that prohibits the construction of new parking (because of a lack of available land), but in a way that might facilitate shared parking (i.e., some businesses are close to one another, but have different peak times—such as a clinic and a restaurant—so as to enable them to share parking).

The principal strategy in this combination is the expansion of parking meters. Traditionally, parking meters have not been widely installed in commercial districts outside of the CBD. Donald Shoup (*46*), however, recommends that on-street meters be extended into such areas in order to introduce pricing. To enhance political acceptability, he recommends that the revenues generated from these meters be used in whole or in part to fund improvements to these neighborhoods, which he calls Parking Benefit Districts.

The revenues could be used for various infrastructure improvements, although, in order to keep the improvements proximal to the source of the revenues, they should be related to the transportation system in general. They could include bus shelters, bicycle paths, and pedestrian amenities (e.g., sidewalk repair, street lamps, and landscaping). This combination of strategies consists of the elements listed in Table 32.

The principal difficulty with implementing commercial benefit districts lies in convincing firms that parking meters and permit systems will not negatively affect business. The idea of using parking meter revenue specifically to enhance the amenities of the district is meant, in large part, to counter businesspeople's objections. Other difficulties are identified in Table 33.

TABLE 31 The new growth combination strategy: potential problems and solutions

Political Feasibility Issues and Unintended Negative Consequences	Possible Solutions
Differential effect on low-income drivers and others negatively affected by this combination	Compensation through revenues from fees and meters, used to • Finance transportation demand management programs
Spillover parking	Implement residential permit programs
Inadequate supply of parking in the long term	Allow for some land banking or future zoning modifications; valet parking; priority parking for carpoolers

TABLE 32 The commercial district combination strategy: assessment of individual components

Individual Strategy	Effectiveness	Political Feasibility	Potential for Realizing Revenues	Ease of Administration
Expanding meters and accompanying residential permit programs	Low to moderate	Moderate	High	Low to moderate
Shared parking	Low	Moderate to high	Low	Low to moderate

The Residential District Combination Strategy

This combination strategy addresses parking problems in high-density housing areas. In larger cities, high-density residential areas are increasingly facing the problem of inadequate parking accommodation. If these are within or next to commercial areas, the greatest threat is spillover parking from nearby business districts, where both on-street and off-street parking is frequently filled to capacity by commuting employees, clients, and customers. This last combination of strategies targets areas where a shortage of residential parking is the primary problem.

In these residential areas, restricting the amount of parking used by nonresidents, in conjunction with providing more off-street parking for residents, may be a more important policy goal than either increasing transit ridership or decreasing SOV use. Thus, while residential permit programs are an essential component of this combination, so is the expansion of meters, even into residential areas.

The implementation of a residential permit program requires the consensus of most residents in approving the program; it also involves an in-depth survey to verify the extent of nonresident on-street parkers. These procedures, along with the annual fee for the permit and the limited time for residents' visitors, detract from the political feasibility of residential parking permit programs. In addition, many such high-density areas are next to a commercial district or activity center (which is the reason why there is spillover parking into the areas to begin with), and firms in those districts are likely to oppose measures that would restrict customer and client parking.

Thus, as with the Commercial District combination strategy, the researchers propose that revenues resulting from the meters and parking permit fees in the Residential District combination strategy be used to fund neighborhood improvements. Sidewalk repair, tree planting, construction of small parks, and bicycle lanes are amenities that would enhance a residential neighborhood, as well as the adjacent commercial area. This combination consists of two strategies, expanding meters and accompanying residential permit programs, as shown in Table 34.

As with the Commercial District combination strategy, the principal difficulty in implementing the Residential District combination strategy lies in garnering support from most res-

TABLE 33 The commercial district combination strategy: potential problems and solutions

Political Feasibility Issues and Unintended Negative Consequences	Possible Solutions
Differential effect on low-income drivers and others negatively affected by this combination	Exempt residents from paying to park at meters within district Compensation through revenues from meters, used to • Enhance transit service • Finance improvements in the district's transportation system and infrastructure, as well transportation-related amenities, including off-street parking
Spillover parking into additional areas	Implement expansion of meters and residential permit programs into areas of spillover

TABLE 34 The residential district combination strategy: assessment of individual components

Individual Strategy	Effectiveness	Political Feasibility	Potential for Realizing Revenues	Ease of Administration
Expanding residential permit programs	Low to moderate	Moderate	Low to moderate	Low to moderate
Expanding meters into residential areas	Low to moderate	Low to moderate	High	Low to moderate

idents and nearby businesses. Again, using the revenues to compensate those made worse off makes the strategy more acceptable. This is detailed in Table 35.

CHAPTER SUMMARY AND CONCLUSIONS

Table 36 summarizes the information in this chapter regarding the essential and important strategies that constitute each combination, those that are necessary complements (for addressing political feasibility and unintended negative consequences), and recommended compensatory mechanisms in instances where strategies generate revenues. Taken together, these elements constitute a package approach to parking policy. In other words, it is not enough to implement certain restrictive parking strategies—complementary strategies that address spillover problems or that improve transit service are also necessary, as are other programs, such as neighborhood and transportation system enhancements that can contribute toward the compensation of those whom individual strategies make worse off.

It is not possible to identify the one best individual strategy or the one best combination, although the combination approach is superior to the individual strategy approach. The parking strategy combinations must be tailored to fit individual problem contexts and policy goals. In addition, the researchers have found that conditions vary from city to city and across metropolitan areas. This implementation guide can, at best, suggest approaches that policy-makers might consider, but it cannot be considered a definitive, infallible tool. Policy-makers must consider the unique, distinct characteristics of their own city, region, parking problems, and overall transportation goals.

This combination package approach to parking underscores one important philosophical position that should guide policy-makers regardless of their location or particular problems and goals: parking strategies need to be considered within the larger context of a regional transportation plan; they work not as an adjunct to transit and infrastructure planning but as an integral part of a comprehensive and coordinated transportation policy. In addition, enhanced transit service is an important component of nearly all of the combinations; thus, transit agencies must become more involved in parking policy formation and implementation.

TABLE 35 The residential district combination strategy: potential problems and solutions

Political Feasibility Issues and Unintended Negative Consequences	Possible Solutions
Differential effect on low-income drivers and others negatively affected by this combination	Exempt residents from paying to park at meters within district Compensation through revenues from meters and permit fees, used to • Enhance transit service • Finance amenities in the neighborhood and improvements in its transportation system and infrastructure, including off-street parking
Spillover parking into additional areas	Implement expansion of meters and residential permit programs into areas of spillover

TABLE 36 Combination packages by policy goal and component strategies

Policy goal / Strategy	Encourage transit ridership through explicit parking pricing in areas of congested peak-hour travel and parking	Encourage transit ridership by workers who park free in employer-leased parking	Encourage transit ridership by employees and users of special generators: high-density employers with limited parking supply	Address parking problems and decrease SOV use in suburban activity center or other noncentral area of growth	Encourage transit ridership through explicit parking pricing in non-cbd commercial areas with parking problems	Address parking problems in high-density housing areas susceptible to spillover parking from nearby commercial areas
Increasing parking price by tax on revenues	++	0	+ (See ** below)	0	0	0
Cashing-out employer-provided parking	+	++	+	NA	0	NA
Expanding on-street meters	+	C	C	+	++	+
Expanding residential permit programs	+	C	C	C	C	++
Parking impact fees on new development of parking	C	C	0	++	NA	NA
Changes in zoning ordinances to restrict parking supply	C	C	0	++	NA	NA
Shared parking	C	C	0	++	++	NA
Transportation demand management	C	+	++	+	+	NA
Compensatory mechanisms						
Cash-out subsidy	+	+	+ (See ** below)	NA	0	NA
Financing of transportation demand management	++	+	++ (See ** below)	++	0	NA
Enhanced transit service	++	+	++ (See ** below)	0	++	+
Improvements/amenities in infrastructure or transportation system	+	0	0 (see ** below)	0	++	++
Reduction of other taxes	+	0	NA	0	0	0
Combination name	**Parking Market**	**Cashing Out**	**Special Generator**	**New growth**	**Commercial district**	**Residential District**

** special generators may increase the price of parking through internal measures, in which case the revenues may be used to finance company-sponsored compensatory mechanisms

++ essential component + important component 0 neutral component C complementary component NA not applicable

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

INTRODUCTION

This study has looked at the extent to which parking strategies might be used to increase transit ridership. The general conclusion is that no single strategy—such as a cashing-out program or increasing the price of on-street parking—is both effective enough and politically feasible enough to warrant implementation on a large, regional basis. Instead, strategies should be implemented in "combination packages" tailored to fit specific policy goals for individual parking- and transportation-problem contexts. These packages should include parking strategies appropriate to the context, complementary strategies that offset any unintended negative consequences, and compensatory mechanisms such as transit enhancements.

This chapter will summarize key findings from the research and present some conclusions that have emerged from the researchers' study of the relationship between parking and transit. Recommendations for further research will follow.

SUMMARY FINDINGS

The Problem Context

Transit ridership depends on many factors, including the level of transit service, population density, and demographics. This research, as well as that of others, has found that transit ridership depends particularly on the supply and pricing of parking. Where supply is ample and the price is low or free, SOV use is encouraged and, as a result, transit ridership declines.

Historically, policy-makers have not used parking strategies to stimulate transit ridership; instead, accommodating parking demand has been their primary goal. By the 1970s, however, concern about the environment and central city decline prompted policy-makers in some urban areas to consider using parking strategies as part of a larger transportation policy aimed at reducing SOV travel, increasing transit ridership, improving air quality, and enhancing access to the CBD.

Whatever the rationale, policy-makers have considered and implemented various strategies—from reducing supply to increasing parking prices. This report considered the economic justification for increasing parking prices. Although some analysts believe that drivers pay for most of the cost of parking either directly or indirectly, this report concluded that indirect payment of parking costs is not an effective means of connecting costs and behavior. In addition, there are economic inefficiencies—such as the underpricing of road use—elsewhere in the overall transportation market. Parking pricing has emerged as a reasonable response to these deficiencies.

In considering the economic context of parking policy, the researchers also asked whether strategies were likely to have inequitable geographic effects, encouraging decentralization trends. In general, in low-density locations, such as the suburbs, where the supply of parking is ample, providers of parking are more likely to bear the incidence of any price increase. In high-density areas, such as the CBD, providers are more likely to pass the price of parking onto users. In many cases, this difference in incidence makes the low-density, suburban location more attractive to firms and employees, thus reinforcing decentralization tendencies. A flat, regionwide parking fee—which, because of its uniformity, appears equitable on the surface—would be likely to have this sort of inequitable geographic effect.

The Present State of Parking and Travel Behavior in the United States

The analysis of the NPTS sample of 20 consolidated metropolitan areas revealed that nearly 75 percent of commuters drive alone; only 7 percent use public transportation (the remainder use other modes, such as carpooling and walking). Part of the explanation for the high SOV share lies in factors related to transit service levels or population density. Another explanation is that parking policies continue to accommodate the automobile. A minority of the cities the researchers studied implement a coordinated, comprehensive transportation policy that includes restrictions on parking (including pricing through taxation) to limit SOV use and stimulate transit ridership.

Parking, Transit Service, and Transit Ridership

The researchers found that, in general, those cities that implement restrictive parking strategies also tend to have higher levels of transit service and transit ridership. The research team found that parking price, in particular, has a positive effect on transit ridership; in fact, the effect of parking

price was found to be *greater than* improvements in transit service.

The most effective means of increasing transit ridership, however, is to increase the pricing of parking *and* improve transit service. In addition, improvements in transit frequency appear to have a greater effect than improvements in transit access. Finally, raising parking prices at the low end (e.g., from $20 per month to $30 per month) is likely to have a greater effect on transit ridership than raising parking prices at the high end by the same amount (e.g., from $90 to $100).

Political Feasibility Issues

The researchers looked at various parking and other strategies in terms of effectiveness in increasing transit ridership. They found some strategies to have a very high effect on increasing transit share. For example, implementing a flat $5-per-day regionwide parking fee could result in an SOV reduction as high as 36 percent, with a similarly high increase in transit ridership (not *all* of that 36 percent would be diverted to transit; where transit service levels are low, people would probably turn to carpooling instead).

It is not, however, realistic to consider implementing a flat $5-per-day regionwide parking fee. Political feasibility problems make such a broad policy inappropriate and highly unlikely to garner sufficient support for implementation. This report considered several questions concerning political feasibility:

- Who are the interest groups (stakeholders) in the parking and transportation policy process? Which groups are likely to benefit from a given parking strategy and which are likely to be made worse off?
- How might low- and middle-income groups be affected by a strategy? Any strategy that results in the foregoing of necessary trips by low- and middle-income groups, who might not be able to afford increases in parking prices, is not desirable.
- Can revenues from parking strategies be used to compensate those whom other strategies make worse off? The researchers concluded that revenues might be used in various compensatory ways: subsidizing cashing-out; substituting for other, less efficient transportation taxes; and financing improvements in public transit and in the transportation infrastructure.
- Does a given strategy make society as a whole better off to an extent that would justify some interest groups being made worse off, even without compensation? In other words, would reductions in air pollution and other negative externalities in the overall transportation system be sufficient to offset inequities or other unintended negative consequences of a particular parking strategy?

Assessment of Transportation and Parking Strategies

The researchers considered several general transportation strategies as well as specific parking approaches aimed at increasing transit ridership through a reduction in SOV use during the work trip. Using the Short-Range Transportation Evaluation Program, the team estimated mode shares as a result of the implementation of different travel and parking strategies in five West Coast metropolitan areas. An employee parking charge of $3 per day was estimated to produce a greater percentage change in regionwide SOV work trips than congestion pricing, an emissions fee, a gasoline tax increase of $2, or a mileage-based fee. To take into account differences in incidence because of variations in density, the researchers also analyzed the effect of a parking price that varies by density, at $5 in the urban core, $2 near the core, and $0 in the suburbs. They controlled for three levels of transit service (i.e., high, medium, and low), size of city (i.e., small or large), location of traveler's residence (i.e., urban core, near core, or suburbs), and whether or not carpoolers would be exempt from the parking fee. The team estimated that the reduction in SOV work trips would be greatest in urban areas with high levels of transit service and with carpoolers exempt from increases in parking pricing.

The researchers also assessed five price-based parking strategies (i.e., increasing the price of parking, based on a tax on revenues; increasing the price of parking, based on a tax on parking spaces; cashing-out employer-provided parking; expanding meters and accompanying residential permit programs; and parking impact fees) and three nonprice-based strategies (i.e., changes in zoning ordinances to restrict parking supply, shared parking, and TDM approaches). For these assessments, the researchers based their analysis on travel data from Portland, Oregon, using destination- and mode-choice models. Case studies of other areas and contexts were also conducted to provide illustrations of implementation issues.

The team found that increasing the price of parking, based on a tax on spaces, is likely to have the greatest effect on SOV and transit share, but is also the broadest strategy in terms of scope and lowest in rating in terms of political feasibility, efficiency, and ease of administration. TDM devices, such as satellite parking-shuttle lots and preferential parking for carpooling, were estimated to have relatively low modal effect, but generally a more targeted scope and moderate to high political feasibility, efficiency, and ease of implementation. Programs that were rated as "moderate" in most of the categories (effectiveness, scope, political feasibility, efficiency, and ease of administration) included cashing-out employer-provided parking and expanding meters and permit programs.

That no single strategy was found to be effective in terms of reducing SOV use and political acceptability led the researchers to conclude that a combination of strategies, tailored to fit specific problem contexts, was the preferred policy option.

RECOMMENDATIONS FOR FURTHER RESEARCH

The researchers encountered several difficulties or problems that limited their analysis and suggest areas for further research. In other cases, they became aware of opportunities in areas that may merit further consideration. These situations have resulted in the following recommendations for further research.

- Error in the measurement of parking price introduces errors in modeling the effect of parking price changes in the travel demand models used by most Metropolitan Planning Organizations. One problem is that parking price variables are based on reported parking charges, which are largely confined to the CBD and are zero elsewhere. This presents a difficulty when zonal parking price averages are calculated; some zones may appear to have lower parking prices than they do because of the high number of zero parking charges reported. Another problem related to parking price measurement is that only auto users are asked about the parking price they pay; nonauto users are not asked about the prices they face. More research is needed in the areas of measuring parking price; capturing the effect of travelers who walk in order to avoid parking charges; the effect of "free" employer-provided parking; and refining techniques such as using posted parking prices at destinations as a way of capturing the parking price that *all* travelers would face.
- More research is needed in the areas of parking impact fees and the use of in-lieu fees. Both of these attempt to internalize the cost of additional parking needs. They provide developers with an incentive to provide less parking (or enable them to do so), which in turn stimulates market pricing of nearby parking. These approaches also generate revenues, which can in theory be used to finance transit improvements, shared parking, and other mechanisms for compensating those made worse off. However, there are currently legal restrictions in place regarding the divertability of effect and in-lieu fees. More research is needed to see how the law might be changed to allow for the use of these revenues for transit improvements.
- More research is needed on how reduced parking supply affects business sales and the local economy, on the cost of administering parking programs, and on how existing parking spaces might be used more efficiently through mechanisms such as shared and valet parking.
- More research is needed to test the hypothesis that most drivers would rather spill over on to unpriced parking spaces than switch to transit (i.e., that free spillover parking is a better substitute for priced parking than high-quality transit service). The extent to which this is true supports a major assumption underlying this report—that priced parking in high-density areas may encourage decentralization over the long term, because travelers would rather park in free on-street spaces in the suburbs, despite the higher levels of transit service in the higher-density locations.
- In-depth case study investigation is needed at specific locations where parking pricing has been employed in conjunction with transit improvements, carpooling incentives, measures to control spillover parking, and other strategies. This research should examine how the combination of such strategies—as opposed to any single strategy—has affected mode choice. Such research should include a longitudinal analysis of TDM and employee-commute option rule experiences to assess the modal shifts that are attributable to changes in parking pricing and regulation implemented in conjunction with transit service improvements. Care is needed in comparing programs in different cities having different contexts (particularly in terms of land use mix and density).
- More research is needed regarding the long-term effects of transportation and parking strategies. This requires better models of locational behavior. Most present models are limited to estimating the effects of strategies actually in place. It has been difficult to model the effects of strategies not within the range of actual experience. Stated-preference modeling techniques may prove useful in estimating mode shift resulting from nonexisting strategies. Cross-national comparisons of programs that exist in some places but not in others may also prove useful.
- To improve the basis for reducing parking minimums and to impose parking maximums in zoning ordinances, improved data are needed on parking ratios, stratified by land use, location, price, and time.
- More research is needed on creating Parking Benefit Districts to subsidize transit and traffic improvements from parking revenues, both as a means of achieving broader areawide transportation objectives and as a means of enhancing the political acceptability of parking meter programs.
- The concept of shared parking provision needs exploration. Research should focus on how legal constraints and requirements could be overcome and on the kinds of incentives that might prove useful in encouraging developers to participate in a shared parking program.
- Research is needed on correcting deficiencies in the U.S. tax code related to employer-provided parking. Provisions that value employers' parking subsidies more highly than subsidies of other forms of transportation and provisions that would make *all* transportation benefits taxable if any individual one becomes so are examples of elements in the tax code that need examination and revision. Cashing-out programs, in particular, would benefit from research such as this.
- As will be discussed in the final section, the success of many of the parking strategies detailed in this report depends on their being tailored to specific problem areas and included in a coordinated and comprehensive

transportation policy that applies throughout a region. Metropolitan-level oversight, coordination, and implementation may be necessary. Research is needed on the possible form of metropolitan-level coordination of comprehensive regional transportation policy.

CONCLUDING REMARKS

Recent federal air quality and transportation legislation has combined with local concerns about the environment and central city decline to spur policy-makers into reevaluating the way they think about parking policy. There is strong support at many levels for strategies that reduce automobile use and increase transit ridership and other forms of alternative transportation. This report has focused on the use of parking strategies to address these policy goals.

Reducing automobile use and increasing transit ridership are, however, broad and complex policy goals. When examined carefully, these goals actually consist of many smaller objectives, such as reducing congestion in a CBD, encouraging carpooling in a suburb, reducing the number of employees who park free, managing spillover parking in residential neighborhoods, addressing parking shortages in commercial districts, and so forth. There is no single strategy that effectively addresses either the broad goals of "reducing automobile use" and "increasing transit ridership" or the more specific objectives that constitute those broader goals.

Rather, policy-makers need to identify specific, individual parking problems within a region and think of these problems narrowly in terms of location. For example, policy-makers should consider the problems that exist in a congested CBD, in a remote activity center, at a university, or in a residential neighborhood. Policy-makers then need to identify a *combination* of strategies to address the localized problems in a multifaceted manner. The combinations should include complementary strategies that offset unintended negative consequences from any given individual strategy—for example, extending parking meters to control spillover parking that might result from increasing the price of off-street parking. The combinations should also include compensatory mechanisms—most importantly, financing improvements in transit—to accommodate drivers who are diverted from driving and to enhance the political acceptability of the strategies.

Finally, parking policy should not be thought of in isolation from transportation policy in general. Policy-makers may need to rethink how they approach parking, and mechanisms should be put in place to make it easier to coordinate parking policy with transportation policy in general. For example, municipal parking officials should be able to work with transit agencies. For this coordination to occur, and for a regional approach to parking to take place, strong regional planning and policy-making mechanisms and institutions need to be developed. From a transit perspective, transit agencies need to be active in parking policy-making, particularly in the crafting of combination packages that involve transit enhancements as a significant component.

Although metropolitan areas should strive toward a regional approach to problem solving in both parking and transportation policy, thinking and acting regionally may not be enough. This research has revealed, for example, that economic inefficiencies exist in the parking market as a result of federal legislation that discourages flexibility and choice in employee parking. Such legislation will need to be changed if the cashing-out strategy is to be successful. In the meantime, at the local level, jurisdictions will continue to grapple with the ramifications of parking proposals such as extending residential permit programs and changing development ordinances to reduce parking minimums and impose parking maximums. This research has revealed that these processes can become highly complex and politicized, with conflicts of opinion and difficulties in implementation that can take as much as a decade to resolve. Many of the changes that might result from parking policy will take time in and of themselves—in fact, their long-term effects are almost impossible to estimate. This, combined with the complexity of problem solving and coordination from the federal level down to the local level, calls for moving forward promptly with the recommendations contained in this report.

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APPENDIX

INTERVIEWS BY CITY

Boston
- Benson, Charles, Boston Transportation Department
- Doherty, Jane, Boston Transportation Department
- Fidaca, Gina, Boston Transportation Department
- Hampton, Jeffrey, Boston Redevelopment Authority

Buffalo
- Fox, Irving, New York State Department of Tax & Finance
- Gallagher, Thomas, Buffalo Board of Parking
- Leone, Charles, Buffalo Department of Finance and Administration
- Manuel, Frank, Buffalo Planning Department
- Sciolino, Leonard, Buffalo Parking Enforcement

Chicago
- Deters, Fred, Chicago Planning and Development Department
- Green, Gil, Chicago Bureau of Parking
- Smith, Joe, Chicago Bureau of Parking

Cincinnati
- Alexandria, Leslie, Cincinnati Building Department
- Cullen, Charles, Cincinnati Parking Facilities Division
- Holland, Lanny, Cincinnati Parking Facilities Division

Cleveland
- Brown, Robert, Cleveland City Planning Commission
- Cole, Joe, Northeast Ohio Coordinating Agency
- Coyne, John, AMPCO Systems
- Michalko, Dorothy, Cleveland Division of Assessments & Licensing
- Ritz, David, Cleveland Division of Traffic Engineering
- Stevens, Lee, Cleveland Parking Division

Dallas
- Camper, Velada, Dallas Public Works & Transportation Department
- Crowly, Charles, Dallas Planning Department
- Jones, Linda, Dallas Controller's Office
- Jordan, Bob, Reunion Center
- Owens, Alex, Dallas Parking Enforcement Department
- Tynan, Hal, Dallas Department of Transportation
- Williams, Shanya, Dallas Convention Center

Denver
- Brookhouse, Kelly, Denver Parking Management
- Gilles, Roberta, Denver Parking Management
- Riley, Tom, Denver Parking Management
- Thomas, Elvera, Denver Zoning Administration

Detroit
- Adebayou, Michael, Detroit City Planning Commission
- Cassells, Norman, Detroit Planning Department
- Studzinski, Sandra, Detroit Municipal Parking Department

Hartford
- Brodacki, Leslie, Hartford City Planning Department
- Klee, Paul, Hartford City Planning Department
- Violette, Carroll, Hartford Public Works Department
- Hess, Jean, Hartford Public Works Department

Houston
- Albrecht, Joel, Houston Municipal Courts, Parking Division
- Harsin, Stephen, Houston Department of Planning & Development
- Rosborough, Dave, Houston Downtown Merchants Association
- Somerville, Richard, Houston Department of Finance & Administration
- Tobias, John, Houston Municipal Courts, Parking Division

Los Angeles
- Buitrago, Hector, LA Department of Buildings & Safety
- Friedman, Larry, City of Los Angeles
- Glick, Thomas, City of Los Angeles
- Lepis, Alice, LA Department of Transportation
- Park, Chris, Warner Center TMO
- Peterson, Karen, Department of Transportation
- Prepena, Raphael, Department of Transportation
- Royster, Tony, LA General Services Department
- Vir, Haripal, City of Los Angeles

Miami
- Baron, Frank, Metro Dade County
- Crowley, Maria, Metro Dade County
- Cummings, Gwen, Miami Parking System
- Guerra, Jesus, Metro Dade County
- Lukin, Adam, Miami Downtown Development Authority
- Ramirez, Sergio, Miami City Planning Department
- Valera, Roamy, Miami Parking System

Milwaukee
- Angelos, Cindy, Milwaukee Parking Department
- Richardson, Ed, Milwaukee City Planning Department
- Wolff, Tom, Milwaukee Parking Department

New York
- Chanda, Shampa, NYC City Planning Commission
- Fox, Irving, New York State Department of Tax & Finance
- Matarangelo, Richard, NYC Department of Transportation

Philadelphia

Duckett, Ronald, Philadelphia Parking Authority
Franks, Evelyn, Philadelphia Parking Authority
Garfield, Steve, Philadelphia Parking Authority
Lehton, Andrew, Philadelphia Planning Department

Pittsburgh

Boule, Anthony, Pittsburgh Parking Authority
Brown, Tim, Pittsburgh Planning Department
Hassett, Pat, Pittsburgh Planning Department
Pallotta, Richard, Pittsburgh Parking Authority

Portland

Arrington, G.B., Tri-Met
Coleman, Elsa, Portland Bureau of Traffic Management
Dotterer, Steve, Portland Department of Transportation
Fink, Patricia, Tri-Met
Gossett, Lynn, Veterans Administration Medical Center
Klein, M., Portland Development Corporation
Kowalczyk, J., Department of Environmental Quality
Logsdon, D., City of Portland
Ornelas, Louis, Oregon Health Sciences University
Park, Kathleen, Oregon Health Sciences University
Royce, Francie, Portland Bureau of Traffic Management
Williams, R., Association for Portland Progress

Providence

Lepore, Michael, Providence City Planning Department
Price, Darleen, Providence Department of Planning and Development
Violette, Earleen, Providence Traffic Engineering Department

San Francisco

Beckman, Ben, San Francisco Department of Parking and Traffic
Chin, Stanley, San Francisco Traffic Engineering Division
Gamble, Martha, San Francisco Department of Parking and Traffic
Robbins, Jerry, San Francisco Department of Parking and Traffic
Szeto, Ron, San Francisco Department of Parking and Traffic
Vovakis, Ernie, Contra Costa County, Pleasant Hill
Wycko, Bill, San Francisco City Planning Department
Young, Linda, CCCA, Pleasant Hill

Seattle

Chappa, Santiago, Seattle Division of Administrative Services
Dryden, Deana, Puget Sound Regional Council, Bellevue
Gilbert, Stephen, TransManage, Bellevue
Kilgren, Neil, Puget Sound Regional Council, Bellevue
Kules, Alan, Seattle Land Use Division
McGhee, Leonard, City of Bellevue
Minnick, Joyce, Seattle Engineering Department
Noguchi, Tom, City of Bellevue
Raynes, Loren, Seattle On-Street Metering Division
Rosenstock, Joan, Seattle Office of Management and Planning
Thordarson, Phil, Seattle Engineering Department
Warwick, Margaret, Puget Sound Regional Council, Bellevue